CORRESPONDENCE.

RELOCATION OF RAILROADS.

SPRINGFIELD, Mass., June 22, 1882.

EDITOR ENGINEERING NEWS:

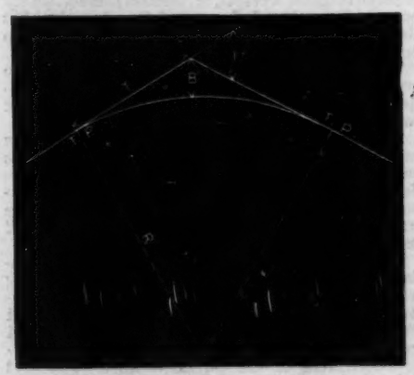
"Engineer," in your paper of June 17, wishes to obtain the most feasible method of making a relocation of a railroad under the rules of the Railroad Commissioner of Massachusetts. Having been engaged more or less for two years in relocating a portion of a double-track road in Massachusetts under said rules, and at present relocating a 17 mile single track branch of same road, I venture to give a few points as found in my experience, particularly the establishing of a satisfactory center line, hoping some may apply to his case. I have always found that the greatest trouble lies in relocating the curves on account of the many compounds in them caused by their being pulled more or less from the original position, and have generally used one of three methods in their alignment. A curve under 800 ft. in length and allowing an intersection of the tangents would often run in by use of rule found in Henck's field book, article 70. By measuring from the point of intersection of the tangents C to the center of the track, if such is the center line, and calling this distance b, then T = tangent and I = angle of intersection; $T = b$ cot. $\frac{1}{4} I$. This method will seldom work on long curves, unless they be very flat. Another method I have often found convenient for locating a point from which to run the curve, knowing the radius that was originally used, is as follows: Produce the tangent to some point, A, say two or three hundred feet beyond the apparent tangent point, and measure $A\,B$ to the center, then the formula for calculating middle ordinates of a curve

$$m = \frac{C^2}{8R}$$

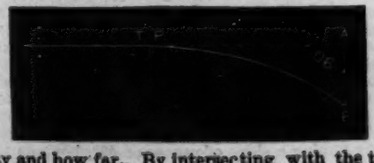
will be found of sufficient accuracy to locate the tangent point. Let $A\,B = m$, then

$$C = \sqrt{8\,R\,m}.$$

By measuring back from A a distance equal to $\frac{1}{2}$ c., a point will be located from which may be run considerable of the curve. A great majority of



the curves, however, that I have had dealings with could not be located by the above methods, so that I have been obliged to resort to the last of these three cases spoken of. I would measure off the curve into stations of 100 ft., and set up at these stations, in the center of the track, stakes or pegs that could be easily seen. I then set the transit at a station, either about midway of the curve or at some place where there was an apparent point of compound curvature, then by taking angles to the stakes at the stations, could quickly determine what curves could be run each



way and how far. By intersecting with the tangents from this point a very long curve can sometimes be run with only one compound. The reason that curves locate better from a point near the middle than from the ends is owing to the tendency of trackmen to lengthen the curves in lining the track, leaving all but three or four hundred feet of each end more nearly where it was originally laid.

Having decided on the location of the center, the widths taken in the original location as shown by the deeds can be located in reference to the new center. This is all a matter of common surveying, its simplicity depending on the data at hand. In the work which I have had in this line the deeds gave the widths taken at each station, and the problem has been to find these stations. Having notes showing where the old division lines crossed the center line I have in all cases used such of them as could be found remaining as a basis for finding the old stations. I would then transfer these stations to the new location, thus giving the proper widths at the points as originally located.

Yours very truly, C. E. ALGER.

RAILROADING IN THE FAR WEST.

SUGAR LOAF, Col., June 19, 1882.

EDITOR ENGINEERING NEWS:

I have been using your new profile book, and like it exceedingly. It is the best in idea and execution I have met with; plate and paper are both very good, and far clearer to the eye than the Queen papers are of late. If a friendly suggestion would not be misunderstood, I would propose what seems to me to be an improvement on it: Add one or two stations in length to the outside of the plate at each end, keeping the heavy tenth station lines in their present position. It is often desirable to see a fill and the cut that is to make it both at the same time. If the grade point comes at the end of a page in your book, this is impossible without skipping a full ten stations or bringing odd stations on the 10th station lines. My suggestion would repeat 200' or 400' on each end of each page, and in 99 cases out of 100 serve all the purposes of the roll or continuous book, and do away with the liability to be torn by the wind when under examination. Another point of change, which might not prove on the whole an advantage, would be the widening of the plate. I am building a line, with a maximum grade of 4.50 per station, a rise of grade line of .135' per page, and in heavy work my line crosses the page three times in the 3,000'. The addition of say 25' in width could be made with an addition of almost nothing to the width of the book, and at any rate keep it smaller than many of our field books, and would adapt your profile book to most of the heavy work which of late years bears a respectable proportion to the whole of the railroad construction of the country. Will you ask through your paper for any practical information as to expansion of rock in going from cuts into embankments with any data accessible. There has arisen a question on the subject here. I have used a number of tests but would like further light on the subject. The grading of the first 20 miles of this line will be completed and the bridges will be put in at once. Labor is plenty but little or no demand in Colorado. Laborers receive $1.75 to $2.00, Rockmen, $2.25 to $2.50, Teams, $3.00 to $4.00, and there are twenty men to take the place of one. Engineers are a drug in the market; probably from 50 to 75 are in Denver to-day out of employment and with little prospect of getting any. Last year anything that could look through an instrument, was in charge of work and to-day they are all out; eastern men don't want to come out here just now; I have never seen engineers so badly off for work as this season.

Yours respectfully,

Asst. Eng. U. P. R'y.

CALCULATING "OVER-HAUL."

ST. GEORGE, N. B., June 21, 1882.

EDITOR ENGINEERING NEWS:

In regard to calculating over-haul, our method is as follows: Calculate the quantities in both excavation and embankment, and enter them on the profile in detail; then, by inspection, see approximately how far the center of gravity of each quantity of excavation will have to be moved to make its share of the embankment. Multiply the quantity by its distance in feet moved, proceed with the next the same, and so on until the excavation is completed, take the sum of all these products and divide the amount by the total quantity moved. The result will be the total haul; from this take the limited haul, in this case 1,000 ft., and the remainder will be the over-haul, this multiplied by ($0.c.) and divided by 100 ft. will give the number of cents per cubic yard extra that should be paid for moving the whole excavation. You will perhaps notice this is a practical approximation by Rankine's formula for center of gravity, case VI., page 153, Civil engineering, 7th edition, 1871. F. W. H.

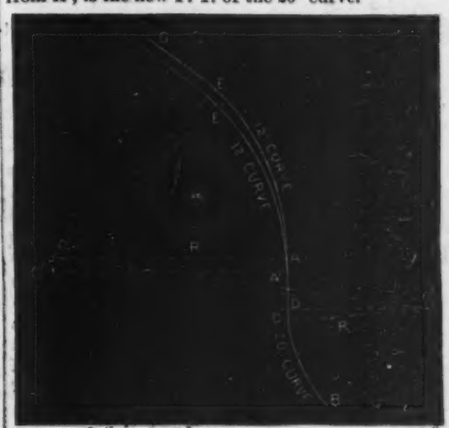
LOCATING CURVES.

PITTSBURGH, Pa., June 21, 1882.

EDITOR ENGINEERING NEWS:

The tenth line from the end of my answer on page 202 should read, "$X\,X$ multiplied by $\frac{1}{12}$ gives," etc.

The following is a graphical solution of "A Subscriber's" problem published last week: Let $B\,D$ be the 20° curve, $D\,A$ the 100-ft. tangent and $A\,E$ the 12° curve. With center C describe an arc $C\,C'$ through C'. Find its intersection, C', with a line parallel to and 478.3 + 25 ft. from the tangent $E\,G$. This is the center of the required curve ($A'\,E'$). Draw $C\,C'$ and lay off the angle $C'\,C'\,A' =$ angle whose tangent is $100 \div (R + R')$. A' (distant R' from C') is the required $P\,C$ and D', 100 ft. from A', is the new P. T. of the 20° curve.



Plotting this on a scale of 40 ft. to the inch I find $D\,D' = 11.3$ ft. ALPHA.

LOCATING CURVES.

LEWISTON, Ill., June 21, 1882.

EDITOR ENGINEERING NEWS:

In answer to inquiry by "A Subscriber" in your issue of June 17, I suggest the following method as giving a very close approximate result. It is apparent that some number of degrees should be "thrown off" from each angle.

Now, the tangent length of a 20° curve for an angle of 60° = 166.24', and that of a 12° curve for an angle of 48° = 212.97'. Then the total distance between points of intersection equals $166.24' \times 212.97' \times 100' = 279.31'$. From this amount deduct 25' leaving 254.31' for such distance when the 12° curve is made to terminate in the new tangent to left. Now suppose that we diminish each original tangent distance by portions inversely proportional to their respective degrees of curvature, viz.: 12 : 20 :: 9.38' (nearly): 15.62' + whence 166.24' − 9.38' = 156.86' × = Tangent distance of a 20° curve for an angle of 57° − 10 (nearly); and 212.97' − 15.62 197.35' ÷ Tangent distance of a 12° curve for an angle of 44° 50'. Difference between these two angles is too great by 20'. If the one be increased and the other diminished 10'; we then have 57° and 45° respectively. Tangent distance of former = 156.33' and of latter 198.15', which with the intervening 100' make 454.46' for distance between points of intersection and differing from that required (254.31') as already shown by $\frac{1}{4}$ ft. and therefore leaving the tangent between curves 100.25'.

Yours truly,

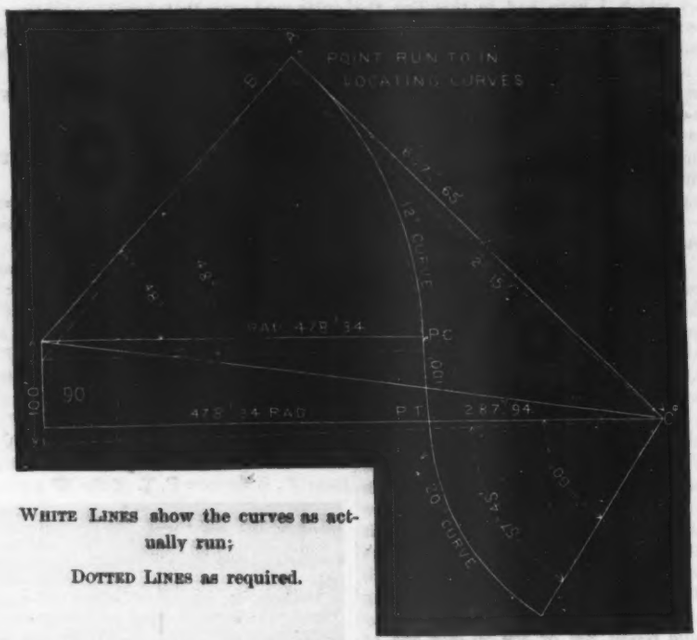
ANOTHER SUBSCRIBER.

LOCATING CURVES.

CLEVELAND, O., June 23, 1882.

EDITOR ENGINEERING NEWS:

In your issue of June 17 "A Subscriber" asks, how many degrees must be "thrown off" the 20° curve, so as to correspond with the case in question. *Answer:* 2° 14′ 48″, or in round figures $2\frac{1}{4}°$, 15′, *i. e.*, the 20° curve will only contain an arc of 57° 45′ instead of 60°.



WHITE LINES show the curves as actually run;

DOTTED LINES as required.

The rule to be applied to this case and to similar ones is as follows: Calculate distance *A C* (see diagram), thence find angle at the center of a circle, with radius = *A C*, subtended by a chord = *A B;* this angle gives the number of degrees to be "thrown off" the first curve. This solution of the problem admits of a very nice graphical demonstration, by drawing a diagram of the case on paper and a copy of same on tracing cloth, thence fastening a pin through both at *C*, as a common center, and swinging the tracing over diagram, until line *A C* on tracing goes through point *B* of diagram on paper.

OTTO DERCUM,
Ass't City Civil Eng.

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES. M. AM. SOC. C. E.

(*Continued from page* 209.)

CCCXLIV.—WESTBOROUGH.

Westborough, Massachusetts, in lat. 42° 17′ N., long. 61° 37′ W., is on a small tributary of the Sudbury River, on uneven ground.

Settled about 1700 it was incorporated as a town in 1717.

Water-works were built by the town in 1878, after plans of C. H. Pierce, taking the supply from Sandra Pond, which receives the drainage of about one square mile. The pond is 2 miles from the centre of the town and 134 ft. above it. An old mill dam, which on examination proved to have been built of rocks and gravel dumped on the natural surface, was strengthened by building a stone wall laid in cement and formed in a trench dug on the lower face of the old work. This wall is 202 ft. long and from 4½ to 11 ft. high. It is 3 ft. wide from bottom to within 5 ft. of the top, and then battered on both sides to the top, which is 2 ft. wide. It was covered on both sides and for 2 ft. over the top with earth and gravel. On the east side of the pond a dam was built across a bay. The heart of this was of puddled clay, and is 105½ ft. long. For 89 ft. it rests on quicksand, through the centre of which a row of sheet piling was driven. Another dam across a ravine was built of gravel and loam and faced with a stone masonry wall 40 ft. long and 6 ft. high, built on a semi-circle and used as a waste-way for surplus water. The reservoir covers about 50 acres and affords storage for 45,000,000 gallons. From a gate-house of brick the water is conveyed to the town by a 12-in. cast-iron pipe for 8,435 ft. The distribution is by 3½ miles of cast-iron pipe of from 12 to 4-in. diameter, with 57 fire hydrants, 25 gates and 356 taps. Forty metres are in use.

The town pays $25 per year for each hydrant.

Service pipes are of wrought-iron.

The population in 1880 was 5,214. The consumption is not known.

The works have cost $53,000, the amount of bonded debt at 5 per cent.

The expenses in 1881 were $1,786.27, and the receipts from water rents $3,119.12, and from the town and other sources $2,248.12.

The works are managed by three Commissioners, one being elected each year. W. R. Gould is Clerk to the Board.

CCCXLV.—PLAINWELL.

Plainwell, Michigan, in lat. 42° 27′ N., long. 85° 30′ W., is on nearly level ground on the Kalamazoo River. Settled in 1860, it was incorporated in 1868. Water-works were built by the village in 1870 for fire protection only, taking the supply from the river, and pumping directly into the mains by water power driving a Holly rotary pump. There is one mile of 6 and 4-in. cast-iron pipe, with 6 fire hydrants and 3 taps.

The population in 1880 was 1,402.

The works cost about $4,000, and the cost of maintenance is merely nominal. J. Sternberg is the Superintendent, under direction of J. P. Hitchcock, the Chief of the Fire Department.

CCCXLVI.—WILMINGTON, N. C.

Wilmington, North Carolina, in lat. 34° 11′ N., long. 78° 10′ W., is on a bluff on the east bank of Cape Fear River, at the head of navigation.

It was settled about 1750. Water-works were built in 1881 by J. A. Cloud, for a private company, taking the supply from the N. E. branch of Cape Fear River, and pumping by a Worthington compound duplex engine of steam cylinders of 12 and 18½-in. diameter, and water cylinder of 12-in. diameter and 10-in. stroke, with an auxiliary high-pressure engine of 14-in. steam, and 8½-in. water cylinders and 10-in. stroke, lifting the water 185 ft. into a stand-pipe 20 ft. in diameter and 80 ft. high.

Distribution is by 12 miles of cast-iron pipe of 12 to 4-in. diameter, with 100 fire hydrants and 30 gates. The number of taps is not given. The city pays $75 per year for each hydrant. The population in 1880 was 17,361. The consumption is not stated. Service pipes are of wrought iron. The works cost $150,000. The bonded debt is $80,000 at 6 per cent. interest.

No other financial statements are given, the works having just gone into operation.

CCCXLVII.—SALAMANCA.

Salamanca, New York, in lat. 42° 10′ N., long. 78° 46′ W., is on the Allegheny River, on hilly ground. Water-works were built by a private company in 1881, taking the supply from a spring brook, the water of which is impounded in a reservoir holding 3,000,000 gallons, half a mile from the town and 150 ft. above it. Distribution is by 3 miles of cast-iron pipe of from 10 to 4-in. diameter.

There are 40 taps. The population in 1880 was 2,800. The number of hydrants and any financial statistics are not furnished. H. O. Wait is the Secretary.

(TO BE CONTINUED.)

The receipt of statistics, as follows, is acknowledged with thanks: From W. R. Gould, Clerk of Water Board, statistics and set of reports of the water-works of Westboro, Mass. From J. B. Cook, Secretary Halcyon Hose Company, statistics of water-works of Plainwell, Mich. From J. A. Cloud, partial statistics of the water-works of Belvidere, N. J., and Wilmington, N. C.

SURFACE RAILROAD BILL VETOED.

ALBANY, June 28.—The Governor has vetoed the bill to provide for the construction, maintenance and operation of street railroads in cities, villages and towns, known as the Surface Railroad bill. His reasons for not approving the bill are as follows:

STATE OF NEW YORK, EXECUTIVE CHAMBER,
ALBANY, June 28, 1882.

Whatever merit of a general character this bill possesses, it seems to be outweighed by objections made by the Mayor and Controller as well as by the citizens of the City of New York, who claim that the public interests of that City are not sufficiently protected from abuse. The third section of the bill provides that the local authorities of the City of New York shall not consent to the construction of any surface railways in said City without receiving payment into the treasury of such consideration as said authorities shall determine; nor shall they consent to the location of a surface railway in Broadway from the Battery to Fourteenth street without first securing payment to the city treasury of a bonus of at least $750,000, and such additional consideration as said authorities may see fit to prescribe. During the last 30 years immense private fortunes have been accumulated from street railway franchises in the city of New York which, owing to inconsiderate legislation, have been granted without adequate compensation to the city. Had there been incorporated into the laws authorizing these grants suitable provisions for securing to the city a portion at least of their ultimate value, New York would now realize a revenue from such a source that would largely diminish the burden of taxation imposed to defray the expenses of its government. The future growth of the metropolis will make many franchises hereafter granted very valuable, and hence, profiting by unmistakable errors in past legislation, subsequent laws should securely provide for the payment into the city treasury of a reasonable percentage on gross receipts, or, instead thereof, should provide for reduced charges of fare in order that the people shall obtain direct benefit from the appreciated value of the respective franchises.

Two distinct objections may be stated to the provision of this bill authorizing the local authorities that grant the use of streets to fix the rate of compensation for the same:

1. The money value of these railroad franchises cannot well be estimated in advance. It remains an unknown quantity until determined by a practical method of fixing a percentage on the earnings or gross receipts. This principle should be established by law and not left to the option of the Common Council.

2. Experience has demonstrated in repeated instances that the Common Council of a great city is not the safe custodian of such interests and authority as proposed in this bill. It has happened often that selfish considerations have intervened and controlled the action of such body to the manifest detriment of the public welfare. The fact that this is a general measure, which, if enacted, would become the fixed law relative to street railway franchises, and the conferring on the Common Council of New York City authority to determine the rate of compensation in such cases, renders it a matter of more than ordinary concern.

ALONZO B. CORNELL.

THE THRUST OF EARTHWORK.*

The author remarks that the number of articles inserted in the "Annales" on the thrust of earthwork and on retaining walls would seem to show that the solutions indicated have not attained the necessary degree of clearness for easy remembrance and application to practical cases. This he attempts to realize in the present note. Surcharged quay walls are treated on, but the case most often presenting itself in the works of the "Ponts et Chaussées" is that of a simple retaining wall, supporting earth with a level surface, and the results of his calculations for such cases he claims can be easily remembered. The earthworks having a slope of repose of 45°, he finds the thrust will be about ⅓ that of water; while with a slope of 30° it will be $\frac{7}{19}$, and with one of 20° about $\frac{2}{5}$ of the same. It is assumed that the earth is not

*Transactions of Institution of Civil Engineers, Vol. LXVIII.

surcharged, that its weight is 1.75 times that of water, and that it thrusts against a vertical-backed wall.*

The author calls attention to the important practical fact that the critical moment for many quay and dock walls is when the water subsides rapidly after a flood. To determine the slope of repose assumed by earth under such circumstances, M. Lagrené made experiments with a model, and found that the light earth used behind the lock walls at Menton, the slope assumed was 24° 13', the weight of the wet earthwork being 1.86 times that of water. At St. Aubin, where the filling was gravelly, this slope was 30°, and the relative weight 1.8. At Notre Dame de la Gavenne the light earthwork slope was 35°, and relative weight 1.58. With gravel and sand mixed, the slope was 30°, and weight 2.15, and with the sand of the island of Mucchauette the slope was 36° 4", and the relative weight 1.534. These variations, the author says, show that the choice of earthwork filling behind lock and quay walls is a matter of importance. B. B.

THE WATER SUPPLY OF VENICE.

Venice, a city of 130,000 inhabitants, with factories and a naval station, has been notorious for its defective supply of water of bad quality, even since the construction of artesian wells in the last forty years.

In 1868 two proposals were made to the municipality, one by Engineer Silvestri, to bring a supply from the Sile at Canizzano, the other by a Belgian company to bring water from the Breuta, in both cases through a conduit along the railway. In 1875, five more projects were submitted, one of which, a combined proposal of civil engineers. Ritterbandt, Dalgarius, and Ponti was accepted. Arrangements for carrying out this work were made in 1879 with a French construction company; the terms of concession being a rate of nearly 1s. 5d. per 100 cubic feet delivered at a height of 164 feet above ground level, a minimum daily supply of 197,180 cubic feet, a storage of 3,530,000 cubic feet, and a duration of concession of sixty years. Finally, some improvements and general modifications suggested by Engineer Fumico were adopted with further alteration, and the works were carried out in general accordance with them by the Societa Veneta.

The supply was taken from the Breuta, above a dam at Stra, and conducted by a channel to the bed of the Seriola, and thence to the filter beds of Morauzani; the supply is 53 cu. ft. per second; but it is proposed to obtain a further quantity from a point higher up the stream. The four filter beds have an aggregate surface of 12,500 sq. ft., the filtering materials being pebbles, gravel and sand, and the surrounding walls being carefully constructed to prevent saline infiltration from the adjoining salt marshes. The filter beds also act simply as reservoirs when the Seriola water is so pure as not to require filtration. Adjoining the filters is the pumping-station, where pumps driven by a turbine raise the filtered water into a collecting reservoir. From this the water is taken in pipes of 2.6 ft. diameter under the lagoons and salt marshes for a distance of about 3¼ miles to Venice. The pipes were laid by means of coffer-dams, the beds being pumped dry, and the pipes generally laid in a concrete trench in the bed of the lagoon. At passages under deep channels and canals, that frequently occurred in these lagoons, special inverted syphons were employed, and a syphon crossing over a bridge in the town was also constructed. The pipes were ordinary cast-iron socket pipes, with lead joints, made by the Società di Marquise and di Terni, weighing in all about 2,550 tons. The reservoir at Venice is built on piles, vaulted and covered with earth; it holds 3,530,000 cu. ft. of water.

A VENETIAN CONSTRUCTION COMPANY.†

This large folio, containing 160 pages of text and seventy plates, gives a detailed account of the more important operations of the Venetian Society in contracts for public works and buildings during the past decade. The society was founded at Padua in 1872 with a capital of 10 million lire, the original syndicate being composed of Messrs. Breda, Forti and Sacchetto, and the shareholders being about thirty-four in number, mostly Italians. The works and buildings undertaken during the decade were: In 1872, Cemetery of Venice, Finance Office at Rome; in 1873, improvement of the banks of the Po, Piave Bridge, improvement of the Venetian lagoons; in 1874, Legnago-Rovigo Railway, Vicenza-Schio Railway, ship-building slips; in 1875, docks at Venice, railways, Vicenza-Treviso and Padua-Bassano, street widening at Treviso; in 1876, St. Martha Quay; in 1877, Genoa Harbor, Fort Aurelio; in 1878, Aonegliano-Vittorio Railway, buildings on the Esquiline; in 1879, Fort Braschi, deepening of the ports, roadsteads, and shores of the province of Naples; in 1880, aqueducts of Vittorio and of Venice, town hall of Vittorio, harbors of Palermo and Licata, maintenance of the Genoa Harbor, and the foreshore of San Pierdarena; in 1881, Mestre-San Michele del Quarto Railway, Benevento-Avellino Railway, Monvalle-Laveno Railway.

In addition to these there were other works in the construction of which the society participated. The profits of the shareholders during this period were 6 per cent. per annum for the first three years, 8 per cent. for the next two years and 12 per cent. in 1878 and 1879; thus showing that the advantages of the society comprise permanence of character as well as direct financial profit, besides conducing to national improvement.

This large volume does not, however, give accounts of all the works undertaken by the society, but merely of some of the more important ones. These are: 1. The Roman Finance Office. 2. The Buildings on the Esquiline. 3. Genoa Harbor. 4. Venetian Cemetery. 5. Venetian Dockyard. 6. Railways within the Province of Venice. 7. Hospital train. 8. The water supply of Venice. The accounts of these are profusely illustrated both by plans, sections and elevations and by artistic drawings.

PILE FOUNDATIONS AND PILE-DRIVING FORMULÆ.

[FROM A CIRCULAR OF THE OFFICE OF CHIEF OF ENGINEERS, U. S. A.]

The above valuable paper is also published in full in Van Nostrand's Engineering Magazine for July. The conclusions arrived at are as follows:

1st. Pile-driving formulæ should be accompanied by tables of factors of safety, corresponding to all the common and easily recognizable kinds of soil.

2d. These factors of safety should be determined on after extended experiments on the supporting power of piles, although approximate factors, which could be used without hazard, could be found from examinations of the records of the driving of the piles of actual foundations, provided the weights of the superstructures are known and descriptions of the soils have been preserved, and provided also that the foundations have carried their loads during sufficient lengths of time.

3d. In experiments on the supporting power of piles, the loads should not rest upon single isolated piles, but they should cover a number of piles driven at those distances apart which are usual in pile foundations.

4th. In every case of construction of a pile foundation, the record of the driving of the piles should include such a description of the soil obtained for borings as would enable an engineer having to found a work in a similar soil to recognize it.

ENGINEERS' SOCIETIES.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

At the meeting of the Society held on June 21, a paper by O. Chanute, member Am. Soc. C. E., subject, "Uniformity of Railway Rolling Stock," was read and discussed. A meeting of the Society will be held July 5, 1882. The succeeding meeting will be September 6, 1882.

ENGINEERS' CLUB OF PHILADELPHIA.

RECORD OF REGULAR MEETING, June 17th, 1882.

President Rudolph Hering in the chair. Nineteen members and two visitors present.

Mr. John T. Boyd described a Shrinking Gauge, which was designed by Mr. Brown, General Foreman of the Works of the Hartford Engineering Co., and enables the average lathe hand to make the "shrinking fits," instead of placing the latter in the hands of one or two first-class machinists in the establishment, which is probably the practice in the majority of machine-shops throughout the country. The gauge resembles, in miniature, an arm-swivel for a tension-rod, in which one of the bolt-ends contains a fine thread screw. The three screws have each a milled head jamb-nut, to maintain them in position when adjusted.

To use the guage, the diameter of the hole in the wheel-hub, collar, coupling, or lever-boss, as the case may be, is first obtained by bringing the inside ends of the large screws in contact, and locking them securely with their respective jamb-nuts; then running the fine-thread screw out until it calipers or gauges the required distance; finally locking the last named screw.

One of the large screws is now unlocked and moved away from the other a distance determined by placing between the inside points of the large screws, and jambing the same, a thin strip of metal, which is in reality the measure of the shrinkage or the difference by which the diameter of the shaft is to be greater than the diameter of the hole. The proportion by which these differences are made is obtained by experiment only and varies with the sizes and materials.

The gauge is well made of steel, hardened where necessary, is light and easy to use and has a complete set of shrink measures, properly marked, for different diameters of shafts.

Mr. Geo. Burnham, Jr., described a wood screw in which the thread, instead of being cut, is formed by passing the blank through a series of rolling, working against stationary, dies. The first set forms a slight ridge only, the second deepens it and so on until a perfect thread is formed. The thread of the finished screw is slightly larger in its outside diameter than the unthreaded neck of the screw, and the point is turned conical and left unthreaded, thus differing from the ordinary cut screw, in which the thread continues to the extreme point. The object of this construction is to adapt the screw to the present mode of using it in soft woods; that is, driving it part way home before using the screwdriver. Bolts are also made in the same way, the thread appearing to the eye as perfect as a cut thread. It is claimed that a bolt made in this way is ten per cent. stronger in the thread than a cut bolt.

Mr. Wm. A. Ingham made some remarks upon experiments in jigging ore. After premising that there are two classes of jigging machines—one in which the tray with the ore is moved up and down under water, the other in which the tray is fixed and the water is forced up and down through the ore bed—he proceeded to comment upon the difficulty he had experienced in obtaining from the books fixed data for the construction of a jig of the second class. He found that great variations prevailed in the practice at different concentrating works. The speeds of the water piston ranged from 48 to 200 per minute and the stroke from 4 in. to ¼ in. There were similar variations in the sizes of the particles operated on, in the length of the screen, in the degree of the inclination of the bed, and in fact the best practice varied at every point.

In the face of such diversities, he was obliged to construct his jig with all its parts adjustable, and determine for himself by a series of trials the conditions best adapted for his work. He soon found that, the other parts remaining fixed, the results could be varied as required by merely varying the piston speed and stroke, and that a high speed was necessarily connected with a short stroke and vice versa. He concluded by promising to prepare a paper on the subject at some future day.

The following Report was presented:

The Committe of Award of "the Prize offered by a Member of the Club, May, 1881," beg leave to report that they have carefully considered the papers submitted for competition, and have awarded the prize of $50.00 for the paper upon a subject strictly in Mechanical Engineering; to Mr. Wilfred Lewis, of Philadelphia, for his paper on the "Application of Logarithms to Problems in Gearing;" and $50.00 for the paper upon a subject of Civil Engineering, to Mr. P. A. Baermann, of West Troy, N. Y., for his paper on "What Thickness of Metal Should Be Given to Cast Iron Pipes Under Pressure;" these being the two papers which, in the judgment of your Committee, conformed the most nearly to the requirements indicated by the Rules heretofore published for the guidance of the Committee. All of which is respectfully submitted.

FRED. GRAFF, *Chairman.*
GEO. BURNHAM, Jr.
HENRY G. MORRIS.
HOWARD MURPHY,
Secretary and Treasurer.

TUNNEL UNDER THE BOSTON MOUNTAIN.—FAYETTEVILLE, Ark., June 24.—At 5 o'clock this morning the workmen of the two ends of the tunnel under the Boston Mountain, 23 miles south of this city, on the line of the St. Louis & San Francisco Railway, shook hands through the division wall. A few minutes later Mr. McDonald, the superintendent of the tunnel works, under the charge of Cameron & Holly, Col. Cameron, and Capt. Hinckley, division superintendent, passed through the aperture made by the completing blows of the workmen. Track will be completed through the tunnel in two weeks. This is the finishing stroke on the St. Louis and great Southwestern thoroughfare. The hole is 1,730 ft. in length, and is the most important work of the kind in the State. The big bridge, 800 ft. long and 123 ft. high, just south of the Boston Mountain, is also about completed. Trains from St. Louis to Fort Smith, by way of the Frisco, will run on the 15th of August next.

*It may be remarked that these results are based upon what was termed in a recent paper on the "Actual Lateral Pressure of Earthwork" (Vol. LXV.) the "ordinary theory," and that they are not corroborated by the results of actual experiment. The criticism of the paper referred to by Continental engineers would lead to the inference that the "ordinary theory" was no longer acted upon on the Continent, but the above note by an engineer-in-chief of the Ponts et Chaussées would appear to lead to an opposite conclusion. —B. B.

†*La Società Veneta, per Imprese e Costruzione Pubbliche* 1872-1881. Bassano: Roberti.

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ENGINEERING NEWS

AND

AMERICAN CONTRACT JOURNAL.

Tribune Building, New York City.

GEO. H. FROST.....EDITOR AND PROPRIETOR.

S. D. V. BURR.....ASSOCIATE EDITOR.

SATURDAY, JULY 1, 1882.

EDITORIAL ANNOUNCEMENTS.

Terms of Subscription.—To the United States and Canada, $4 per annum, including postage; all parts of Europe, $5, payable in advance. Remittances at the risk of the subscriber, unless made by registered letter or by draft, check or P. O. order, payable to GEO. H. FROST.

Terms of Advertising.—One inch, 12 lines, one insertion, $2; one month, $6.50; three months, $17; six months, $30; one year, $50. Special rate for large space and long time will be given on application. Advertisements inserted for less than three months, payable in advance; for longer time, payable quarterly.

Articles for Publication in the current number should be received at the office of publication not later than Thursday morning, and advertisements not later than Friday noon.

Correspondence upon subjects which naturally belongs to the province of this journal is solicited.

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DRAWING INSTRUMENTS, how to use them and how to take care of them; and Some Difficult Problems in Carpentry and Joinery, simplified and solved by the aid of the carpenters' steel square, are Nos. 4 and 5 of Work Manual, issued by the Industrial Publication Company, 49 Maiden Lane, N. Y. Price of each 25 cents.

THE JOHNS HOPKINS UNIVERSITY CIRCULAR is a publication issued monthly by Messrs. John Murphy & Co., 182 W. Baltimore St., Baltimore, at the low rate of five cents each. They are well-condensed abstracts of valuable papers on various subjects, and also give the university meetings, etc.

COMBINATION BRIDGES; Their Merits and Their Cost—A Comparison with Howe Truss Bridges, is the name of an excellent illustrated paper read before the Engineers' Society of Western Pennsylvania, April 18, 1882, by C. L. Strobel, C. E., of the Keystone Bridge Co., and which is published in full in the *American Engineer* of last week and this. The address of our esteemed contemporary is 182 Dearborn St., Chicago.

VAN NOSTRAND'S ENGINEERING MAGAZINE for July has an original paper by Prof. C. M. Woodward, author of the "History of the St. Louis Bridge, or the Basin and Regimen of the Mississippi River," and "Curves and Crossings for Railways," by Prof. S. W. Robinson, of the Ohio State University, Columbus, O. Prof. Robinson has contributed an article on "Railway Economics," read at the annual meeting of the American Society of Mechanical Engineers, in 1881. This is a continuation of that article.

GOV. CORNELL evidently thinks that it is true that something should be paid for the valuable franchises that have heretofore been so liberally voted away to street car and other passenger-carrying companies in American cities, and especially in New York, where large fortunes have been made by the street railway and the ferry companies. We publish his veto of the Surface Railroad Bill elsewhere, and what he says may suggest similar ideas to the councils of other cities. Europeans do not give away these valuable franchises.

THERE is not a copy of "Rawlinson's Suggestions," or "Latham's Sanitary Engineering" (American edition) to be had in this city, and there is not much prospect of there ever being any more copies for sale. Judging from the run on "Greene's Bridges"—60-cent edition—the opportunity to secure this excellent book at this low price will also soon come to an end. We have only a very limited number of copies unsold. The exceedingly practical and simple method it treats of is too well known to be further commented on. The price is less than one-fourth of that of the complete book, while the contents cover the most important points. The price can be sent in currency or postage stamps, and the risk of loss is too slight to warrant the cost of registering, or of buying a money-order. When the small stock on hand is exhausted, the book is out of print, and the price of its successor is two dollars and fifty cents.

THE BROADWAY UNDERGROUND RAILROAD COMPANY.—A bond in the sum of $100,000 has been filed with Controller Campbell, of this city, by the owners of the charter for a Broadway underground railroad. According to the terms of the charter this sum will be forfeited unless a rapid transit underground railroad is completed from the Battery to Forty-second street within four years from the filing of the bond. The charter under which the company proposes to work was granted by the Legislature some ten years ago and is generally known as the Beach Pneumatic Tunnel.

The building of an underground railroad in this city has been most freely discussed for the past few years, but as yet nothing practical has resulted. The matter is now in the courts and, as far as can be leaned, the date for the commencing of actual work must be placed a long way in the future.

HUDSON RIVER TUNNEL.—Since the time of our last visit to the tunnel, the work on both sides of the river has progressed most favorably, and shows a decided increase in the figures representing "completed work." The heading on the New York side has been advanced about 20 ft. further than when last noted. The material passed through being still sand and water, the work is, of course, prosecuted with great care, precautions being taken to guard against the liability of any mishap. There is yet required about 38 ft. of tunnel before the bulkhead wall will be passed.

On the New Jersey side the material still holds good, in fact being better adapted to the method of building than any yet met. The rate of progress is about 4 ft. per day, and the north tunnel has been completed for a distance of about 1,100 ft. from the shaft.

Messrs. Henry Bowie (who was Superintendent when the tunnel was built through the soft spots a short time since), and Chas. A. Haskins have the contract for furnishing all the required labor and superintendence.

WATER RATES, PROVIDENCE, R. I.—The Board of Public Works presented (June 6) a report to the Board of Aldermen in which they stated that, after mature deliberation and consultation with the Committee on Water, with reference to the subject of rates, they had come to the conclusion that any material reduction in the rates would probably increase the deficit of income, thereby increasing the rate of taxation. Should the Aldermen advise a reduction they would suggest the following schedule to go into effect, July 1 next: Where the consumption of water through a single tap amounts annually to $50 or less, per hundred gallons, 3c.; where the consumption of water exceeds in amount the sum of $50, annually, through a single tap, a discount of 10 per cent. on the excess over $50 up to $100 will be allowed and deducted from the amount due for the fourth quarter; on the excess of $100 up to $300 a discount of 20 per cent.; on the excess of $300 up to $500 a discount of 30 per cent.; on the excess of $500 up to $1,000, a discount of 40 per cent., and on all sums in excess of $1,000 a discount of 50 per cent.

A resolution was passed directing the Board of Public Work, to fix the water rates in accordance with the plan they had presented. It is estimated that this reduction, based upon the receipts of 1881, will amount to $20,000.

THE PANAMA CANAL.

Captain George E. Belknap, U. S. Navy, in a communication to Rear Admiral George B. Balch, commanding United States Naval Force, Pacific Station, from Callao Bay, Peru, under date of May 29, gives much valuable information in regard to the actual progress that has been made on the canal. A recent visit to Panama enabled the Captain to make extended inquiries, and in a trip to Aspinwall and back to personally inspect, as far as possible, what had been done since April, 1881, toward the work of excavation. In a conversation with the editor of the Panama *Star and Herald* the opinion was expressed that bad management and extravagant expenditure had characterized the canal officials who had also been unduly reticent in regard to their operations and intentions. This has been overcome, mostly by the fearless criticisms of the above named paper, and the public are in receipt of more varied and reliable statements than heretofore.

The sum of $200,000 has been paid for the Grand Hotel, which has been fitted up for offices at a cost of $30,000; some 200 officials, engineers, draughtsmen, clerks, etc., occupied the building, and yet still the accommodations were inadequate. On Ancoss Hill hospital buildings had been erected and grounds laid out at an expenditure of $200,000, and it was estimated that $300,000 would be required to complete them. The letter reports the editor as stating "that a similar extravagant expenditure had been made on the other side, and yet at no point on the Isthmus had the company a cot or bed of its own in which to put a single sick man." The buildings at Ancoss Hill are described as being built in the most substantial manner, and yet the writer was forced to the conclusion that if the expected sick of the canal employés were to be in proportion to the costly preparations made for them, "the Isthmus could not be regarded, what it is by many affirmed to be, a very healthy and salubrious region."

Mr. Boyd (Editor *Star and Herald*) was of the opinion that M. De Lesseps was far short in his estimates as to the total cost of the canal, and when asked if he believed that $500,000,000 would cut a working sea-level canal he gave no intimation that this amount was excessive. Notwithstanding all the engineering obstacles and climatic difficulties to be met, he was of the opinion that final success would crown the efforts being made.

An American business man of 34 years residence in Panama professed faith in the completion of the canal, but thought it would never reach that stage through the efforts of the present company, but "that the French company would probably reach Gatun with its cutting, when by that time, having exhausted its funds, it would collapse, and American capitalists would step in, take up the work and push it to completion."

The track of the canal has been cleared of trees and underbrush and staked out, and small gangs of men are working at Empire, Gatun and Monkey

Hill. The main work accomplished seemed to be the building of houses, probably for the officers. Although reported that the work of excavating the canal was in progress at Empire, Captain Belknap saw no result that would indicate it.

A steam excavator was working at a bank at Monkey Hill, the dirt being removed on a portable railroad to the mouth of Fox River, where a pier is being built with the intention of making a harbor that will afford safe anchorage at all seasons. At Aspinwall it was noticed that quantities of machinery and lumber and iron were laid along the shore with no protection whatever from the weather. The letter closes with the statement that "the company is still wrestling with the problem of the Chagres River, and what to do with it, as well as with regard to the terminal point of the canal in Panama Bay, although the outlook would not seem to be promising to those personally familiar with the Isthmus, its topography and climate, and the herculean obstacles to be overcome; and people having such knowledge and expecting returns for capital invested, will not be likely to put money in such an undertaking."

In a late issue of the San Francisco *Chronicle* we find an article on the canal purporting to be a report by a recent visitor, and which contains a description of the "Hercules" dredger mentioned in our article of June 17. The apparatus consists of an endless chain, the links of which are each 3 ft. long, about 100 ft. in length and extending from the top of the hopper—45 ft. above the water line—to the point of excavation. Thirty-eight iron buckets, with sharp ends for penetrating the material, are strung on this chain and their contents emptied into a discharge pipe, which is 3 ft. in diameter and 150 ft. long, laid with a pitch of 1 to 10. The excavated material is thus deposited 150 ft. from the center of the canal. Two steam pumps, with a capacity of 20,000 gallons per hour will be used when required to force water into the buckets as they arrive at the top, thereby facilitating the discharge of their loads. The boat is anchored on both sides. Passing through the boat, vertically, are two tubes 2 ft. in diameter, into which fit wooden "spuds" 60 ft. in length and furnished with cast-iron points or shoes weighing 1,800 pounds each. One of these at a time is driven into the mud at the bottom, thus firmly holding the boat. When the work has reached a certain stage on one side of the canal the spud is hauled up by tackle operated by steam and another driven. Thus the dredge, as it does its work, is moved laterally, gaining at each change of position, as a vessel would in tacking. It is stated that two tons of coal will operate the excavator for ten hours. One of these dredges, constructed at the cost of $5,000, and now at work building levees and digging a canal on the San Joaquin, has excavated 9,000 cubic yards of material in ten hours, and the average daily amount, including time lost in moving, is said to be about 5,000 cubic yards.

We quote briefly in regard to the plans of the contractors as follows:

When these dredgers are set in position the contractors affirm that they will have the first excavation, a pass 100 ft. wide by 8 ft. deep, opened to Gatun, 8 miles from Aspinwall, by the 1st of March, 1883; the canal dug to its full width and depth to the same place by the 1st of October, 1883, and the balance of their contract of 7,863,600 cubic yards, including the work for the deviation of the Lower Chagres, by the 1st of August, 1884, provided, of course, that no accidents from the elements occur.

THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

The May Transactions have been issued and delivered to members. Its 28 pages are entirely taken up by the annual address of President Ashbel Welch at the Washington Convention. Mr. Welch, although disavowing at the outset of his address "any general survey of the engineering field," yet has referred to very many, if not all, the principal engineering works now in process of construction. Under tunnels he refers to the St. Gothard, the Musconetcong, Hoosac, West Point, Bergen Ridge and also the proposed Dover Tunnel. The use of improved explosives, drilling and compressed air machinery are referred to in connection with these great undertakings in comparison with the methods in use in the early experiences of the author. Mr. Welch refers to great bridges, elevated railroads, the building elevator, steam heating, interoceanic canals and railroads for ships, and in connection with the canal question he favors the San Blas route. Railroad construction and its connection with the financial condition of the country is treated at some length, and the improvement of the Mississippi River with some of the hydraulic principles, the consideration of which may govern the action of the Commission, occupies several pages. The importance of good country highways is noticed and the author gives some interesting reminiscenses of canal engineering, on which subject he may well be considered an authority. Electricity; iron shipbuilding; the progress of the country as shown by the Post-Office departmental work; geological discovery; weather forecasts; sewerage systems; diamond drill; the life of iron and steel rails; the power and responsibility of corporations; uniform time; tests of metallic structures; checking of baggage, those and other subjects have received more or less notice. The address concludes as follows:

What is, and is to be, the effect of all the activity and progress of the present day on human welfare? Doubtless the preponderance of effect is good, but with many drawbacks. I will notice one. The rapid movement of the business of the world requires an immense amount of brainwork to be done by those who direct it in each business day. This is made possible by the recently introduced facilities for rapid work. Formerly, when a man wrote his own letters, he thought sentences only as fast as he could write them. Now he dictates three or four sentences to his stenographer in the time he would have been writing one, and so performs three or four times as much brainwork per minute as he would if he wrote himself. He does not go out of his office to confer with a man in some other office, but sits still and telephones him. When the railroad officer travels on his own road he does not chat with his friends in the public car, but goes in his office car, with his stenographer, clerks, and table covered with papers. When a man goes home from his office he does not take the time to walk, but works on till the last moment, then goes on the elevated railroad. The brain gets no rest, as it would have got in old times; now constantly rushing forward, not standing in its tracks, as formerly, while the man was writing down the thought of the previous instant; now furiously at work, while the man was going from place to place. This kept up for six or eight hours a day must soon break a man down, and has already broken down some of our ablest men. It does not mend the matter much that next summer he can spend a few weeks at the shore, or among the mountains. A man running up hill till he is out of breath is not enabled to keep on running another hour by the prospect of rest next week. A man that runs a locomotive twenty miles an hour may run all day, but if he runs sixty miles per hour, and so his brain and eye have three times as much to do per hour, he must soon stop to rest.

Undoubtedly the progress of the age, which is so largely engineering progress, does on the whole greatly increase the welfare of mankind. By making the forces of nature do the hard work, the labors of the toiling millions are enlightened many fold. The laboring man now works with brain and eye more than with muscle, and his business is now to apply some principle of science. This raises him intellectually. He now has time for improvement. Comfort and refinement, and even luxury, are brought within his reach. The forces of nature having become obedient to the will of man, they are made to produce for him not only plenty, but conveniences and luxuries formerly undreamt of. By the present facilities, the races of men are brought into contact with each other. Those races are being assimilated, and the prejudices and hatreds of the past are fading away. Supreme power among men is more than ever in the hands of the most enlightened, and they are sending civilization and Christianity into the regions most benighted. The light of Heaven is beginning to shine into the harem and the zenana. And the time seems to be hastening when there shall universally prevail "peace on earth" and "good will towards men."

The proceedings give in detail the work and amusements of the Convention at Washington, with a complete list of members there present. The Norman Medal for the past year was awarded to Mr. L. L. Buck, Mem. A. S. C. E., for his paper on "The Re-enforcement of the Anchorage and Renewal of the Suspended Superstructure of the Niagara R. R. Suspension Bridge." The following are the additions and changes since the last number issued: For members—Enrique Budge, Valparaiso, Chili; Robert Gordon, Henzada, British Burmah; Edward C. Kinney, Chief Engineer St. Louis, Des Moines & Northern R. R., Des Moines, Ia.; Gustav Lindenthal, C. E., Monongahela Bridge, Pittsburgh, Pa.; Thomas C. McCollom, C. E., U. S. N., New London, Conn.; Chas. P. Perkins (from Junior), Engineer P. & E. Div. P. R. R., Williamsport, Pa.; James L. Randolph, Chief Engineer B. & O. R. R., Camden Sta., Baltimore, Md.; David Reeves (from Junior), President Phœnix Iron Co., 410 Walnut street, Philadelphia, Pa.; Benjamin Rhodes, Niagara Falls, N. Y. Changes and corrections—Arthur and Leonard F. Beckwith, 75 Tribune Building, N. Y.; Cabell Breckinridge, Chief Engineer, Alabama Great Southern R. R., Tuscaloosa, Ala.; L. L. Buck, 124 Bedford ave., Brooklyn, N. Y.; S. H. Chittenden, East River, Conn.; E. L. Corthell, N. Y., W. S. & B. R. R., Mills Building, 15 Broad st., N. Y.; Wilson Crosby, 145 Temple Court., 5 Beekman st., N. Y.; C. W. Durham, 19 Fifth ave., N. Y.; Philip Golay, U. S. Assistant Engineer, Paducah, Ky.; Henry Harding, Salem, Mass.; Robt. L. Harris, care of Dr. David Kimball, Portsmouth, N. H.; Wm. M. Hughes, Engineer of Bridges, N. Y., C. & St. L. Ry., Hoyt Block, Cleveland, O.; Walter Kattè, Chief Engineer N. Y., Ont. & W. Ry. and N. Y., W. S. & B. R. R., Mills Building, 15 Broad st., N. Y. City, N. Y.; Wm. H. Lotz, 57 Metropolitan Block, Chicago, Ill.; C. S. Masten, Div. Eng., W., St. L. & P. R. R., St. Louis, Mo.; James R. Maxwell, Chief Eng. & Supt. Cons. D., O. & O. R. Ry., Olney, Ill.; J. Albert Monroe, Div. Eng. N. Y., W. S. & B. R. R., Kingston, N. Y.; Charles E. Moore, Ass't Eng. W., St. L. & P. R. R., St. Louis, Mo.; Marshall Morris, Chief Eng. C. & I. Div. L., N. A. & C. Ry., 530 W. Walnut st., Louisville, Ky.; O. F. Nichols, Res. Eng. Henderson Bridge Co., Henderson, Ky.; Charles Paine, Gen. Man. N. Y., W. S. & B. R. R., Mills Building, 15 Broad st., N. Y. City, N. Y.; William D. Pickett, Fort Washaki, Wyoming; William Rotch, Treas. Connotton Valley Ry., 13 Exchange st., Boston, Mass.; J. Gardner Sanderson, Tribune Building, Room 77, N. Y. City, N. Y.; Clinton B. Sears, Capt. Corps of Engineers, U. S. A., Executive Officer Mississippi River Com., 2,828 Washington ave., St. Louis, Mo.; Horatio Seymour, Jr., Marquette, Mich.; Josè Tintorer y Giberga, Asalto No. 12, Barcelona, Spain; Arthur M. Wellington, Ass't Gen. Man. Mexican Cent. R. R., No. 5 Plazuela de San Fernando, Mexico, Mex.; A. S. C. Wurtele, Ass't Eng. N. Y. C. & H. R. R. R., 60 Chestnut st., Albany, N. Y.; William A. G. Emonts, Sunbury, Northumberland Co., Pa.; Sandford Horton, Peekskill, N. Y.; Thomas Lafon, Sub. Div. Eng. Mex. Nat. Cons. Co., Manzanilla, Mex.; D. Jones Lucas, Lowellville, Mahoning Co., Ohio. Deaths—Gen. John G. Barnard, U. S. Engineer.

PERSONAL.

MR. W. T. R. FENNESSY is Chief Engineer of the new Hannibal, Terre Haute & Indianapolis Railroad.

MR. E. H. BURLINGAME, who was formerly with the Hudson River Tunnel Company, has been reappointed, and has charge of surveys.

MR. C. T. CHURCH has been elected Chief Engineer of the Boston, Hoosac & Western Railroad, vice Mr. E. M. LEUFFER, resigned. Headquarters at Mechanicville, N. Y.

MR. J. M. WOLBRECT, recently in charge of construction of jetties at Charleston, S. C., under Gen. Q. A. GILLMORE, has been appointed Assistant Engineer on the Hudson River Tunnel, and has charge of construction on New York side.

THE saddest part of the story of the lost Jeannette is that which tells how DE LONG and the men with him died. A frozen hand of the leader, sticking out of the snow as though raised up in appeal for aid, told the searchers where three of

the bodies lay. In the pockets of all were pieces of burned skin cut from their furs, of which they had been eating. Starving, freezing, and almost exhausted, it seems that they had kindled small fires, and then actually crawled into the flame in the hope of warming themselves. Such experiences are almost too terrible to be told; but if the story will serve to deter men from encountering like perils under equally unfavorable conditions, it should not remain untold.

IN the way of vastness in a manufacturing establishment, nothing in the past or present can compare with the extent of Herr KRUPP'S, at Essen. Of steam-boilers he has 439; of steam-engines, 456, their aggregate horse-power being 18,500; of steam-hammers, 89; of rolling-mills, 21; of furnaces, 1,556; of locomotives, 25; of machines for making tools, 1,622; and the population of this working-men's city is 15,700.

DR. SCHLIEMANN tempers the heavy drudgery of scientific exploration by a generous diet and a liberal hospitality. He lives in an imposing marble palace at Athens, which bears on its front, above the door, the inscription in letters of gold: "Hall of Ilium." Here every other Thursday evening during the winter he entertains a hundred or more professors, journalists and statesmen. The spacious parlors afford room for more than three hundred guests. All the decorations of the house commemorate Dr. SCHLIEMANN'S great researches. The floors are paved with Italian mosaics, the walls covered with Pompeiian frescoes and patterns of objects found at Troy and Mycenæ, and Homeric mottoes and inscriptions abound. At the family table classic Greek alone is spoken, and even the servants have classic names—the gardener is PRIAM, the porter BELLEROPHON, and the two nurses HECUBA and POLYXENA.

ENGINEER CORPS CHANGES. — The following changes have been made in the Corps of Engineers: Major FRANCIS N. FARQUHAR ordered to Detroit to relieve Major GODFREY WEITZEL of the duty connected with the river and harbor improvement. Capt. CHARLES E. L. B. DAVIS to relieve Major WEITZEL of his duty as as engineer of the 11th light-house district. Major WEITZEL being relieved, to proceed to Philadelphia and relieve Capt. WM. LUDLOW of the river and harbor improvement in his charge. Capt. LUDLOW to report to the Secretary of the Treasury for duty as engineer secretary of the Light-house Board. Capt. JAS. B. QUINN to report to Major CHAS. A. SUTER at St. Louis for duty. First Lieut. WM. H. BIXBY to report to Col. H. L. ABBOTT at Willets Point for duty.

Mr. EMILE LOW, who, with his father, Mr. SIGISMUND LOW, has recently returned from Mexico, gives an interesting account of life in the land of the Montezumas. These gentlemen were members of the party of engineers who went from the states to construct a branch road connecting with the Mexican Central railroad. Mr. LOW is of the opinion that Mexico and the Mexicans are misunderstood and misrepresented by the average traveler from the United States. Many correspondents who are sent there in the interests of American journals confine their investigations to the coast regions, and therefore receive wrong impressions of the climate and country. The party of which Mr. LOW was a member worked about 250 miles northwest of the city of Mexico, and he describes temperature in that district as delightful, the thermometer generally standing at 70 degrees. From 15,000 to 20,000 native laborers are employed in the construction of the Mexican Central, and in the matter of wages these men discount the Chinese, as they average 25 cents per day. They manifest a decided objection to that time-honored vehicle, the wheelbarrow, and prefer to transport the dirt in a piece of coarse cloth, which they lay on the ground to fill, then sling the load over the shoulder and trot off to the dump. The morals of this class are none of the best, and many of the men and women pair off without the formality of marrriage. This state of things is due largely to the fact that a civil marriage is the only one recognized by the law, and the fees demanded by the authorities are so large that the lower classes are unable to pay them.

Mr. LOW is enthusiastic in the praise of the better class of Mexicans, whom he says are people of great culture and refinement and quite hospitable. The corps of American engineers in their expeditions were frequently entertained by the Mexican gentry; in fact, their company was eagerly sought after, and to offer a Mexican of the better class pay for hospitality was considered an insult. The commercial interests of the country are managed generally by Germans. The stock of the Mexican Central road is held in the main by capitalists of the United States, yet not a rail of American manufacture has been laid on the road. The construction supplies come from England and Belgium. As Mexico has no manufactories, all iron productions are imported from other countries, and the goods of all nations, except the United States, are sold there. Mr. LOW rather thinks that the Pittsburg glassblowers who recently returned from Mexico, have exaggerated their injuries, and that the fault was not altogether on the side of the Mexicans. He says that many Americans go there with the idea that they are in a country similar to our far West, and therefore proceed to become something of desperadoes, hence in a very short time they find themselves in the hands of the authorities. He says that he saw cases where the railroad attaches behaved in a manner which would have jailed them at home, and yet the Mexican people were particularly lenient and would release them on payment of a slight fine. The American consul now in Mexico is, according to Mr. LOW'S statement, not very popular, and the American residents of Mexico generally desire his removal.—*Pittsburg Leader, June* 23.

RECENT INVENTIONS.

APPARATUS FOR VENTILATING AND PURIFYING SEWERS.

For the ventilation and purification of the sewers of a city, the inventor provides an apparatus consisting substantially of a disinfecting chamber, having double reticulated walls filled in with disinfecting material, combined and operating in connection with a suction fan or fans. The disinfecting chamber is connected both with the sewers and the open air, whereby the sewer gases may be passed through the walls of the disinfecting chamber by the action of the fan or fans, and thereby purified before being discharged into the open air.

RELEASING COCK FOR RAILWAY CAR-BRAKES.

To insure the quick release of railway air-brakes, a three-way cock is provided, one branch of which connects with the train-pipe, a second with the exhaust and a third with the main reservoir, the latter branch having a spring valve of resisting power equal to the reserve force which it is desired to retain in the main reservoir, and a supplementary passage leading around the valve from a point below it to the interior of the cock. By an additional turn of the handle the supplementary passage is opened into the train-pipe, and the reserve force of compressed air thrown suddenly upon the triple valves under the several cars, cutting off communication between the auxiliary reservoir and brake-cylinders.

CONSTRUCTION TENDER FOR RAILROADS.

The car is provided with a winged truss frame and a detachable derrick or boom. Suitable tracks are placed upon the car, on which trucks are adapted to run. Resting upon a platform supported on posts is a drum shaft capable of longitudinal movement, and which is a cylindrical and square portion, on which is secured a rigid and a loose socketed drum adapted to operate a traveling block backward and forward upon the boom or derrick.

HYDROCARBON FURNACE.

This improved furnace consists of the combination of a bat-wing injector and the water legs of the boiler, the steam pipes covered with refractory material and passing above the grate bars back and forth horizontally directly through a body of incandescent material, whereby the steam is superheated and passed directly in a superheated state to the liquid fuel injector, and discharged, in conjunction with the liquid hydrocarbon, in a broad thin sheet forwardly and laterally immediately out the incandescent fuel beneath the fire-bridge.

APPARATUS FOR OPERATING RAILWAY SIGNALS.

Great difficulty has heretofore been found in the use of wires for operating railroad signals, due to the contraction and expansion of the wires under different degrees of temperature. An English invention secures one end of a section of a signal operating rod or wire, a cylinder containing liquid, and the meeting end of the other section is secured to a piston or plunger working in said cylinder, whereby the expansion and contraction of the rods or wires is compensated for by the expansion and contraction of the liquid.

WASHINGTON, D. C. F. B. BROCK.

RAILROAD ECONOMICS.*

BY S. W. ROBINSON, C. E., OF THE OHIO STATE UNIVERSITY, MEMBER OF THE BOARD OF INSPECTORS UNDER THE HON. H. SABINE, COMMISSIONER OF RAILROADS AND TELEGRAPHS.

A law of the State of Ohio makes it the duty of the Commissioner of Railroads to inquire into the safety of the means employed in railway travel. To this end an inspection service has been organized, which aims to examine and report the condition of all the railroads of the State. While engaged in this duty the following items of information have been gained:

TRUNK AND OTHER LINES.

In Ohio, as well as in at least two other States, there appear to be two classes of railroads—first, the great trunk-lines connecting the West with the East, and, second, those having largely or altogether local interests. The former are most likely to run east and westward, while the latter run mostly north and southward. Strong companies control the former, while the latter often fail to pay well enough to keep up repairs. In many instances a weak company sells its interests to a stronger, when the former causes a general need of repairs. The strong company or trunk-line then puts the road into good running condition, sometimes to form part of a through line, sometimes a branch and sometimes to form a tributary to it. In this way a road of secondary importance may be kept up to good running condition, while otherwise it would go down.

Whatever may be said against consolidation of railroads, it appears to be a fact that roads owned by strong and wealthy companies are in far better condition than otherwise. Indeed the generally good condition of the great trunk-lines and of their branches is a credit to those companies. If these roads are backward in some things, such as introducing the best systems of "signaling," "blocking," and of "interlocking apparatus," they are certainly up in other matters, such as steel rails, iron bridges, etc.

SAFETY.

A little attention to railroading will suffice to show that safety in railroad travel is the price of incessant vigilance. That a stretch of three hundred miles, extending across a State is, every foot of it, perfectly safe to-day, is not proof positive that it will be so to-morrow, though the broken rail or washed culvert is the subject of constant search.

PROTECTION OF RAILROAD STRUCTURES.

The life of railroad plant is not great. New roads, with iron rails and wooden structures, will need renewals for the most part within ten years. Rails endure according to traffic and for light traffic will run ten years. Ties will rot out in from five to eight years. Culverts, cattleguards, etc., about the same. Good wooden bridges, when new, will be dangerous in ten years unless covered. If covered at all it should be done within two years after building; otherwise the timber becomes affected with dry rot at the heart. This decay might perhaps better be called *blind rot*, because it is hidden. A wooden bridge, nicely covered and painted, may *appear* to be in the best of condition, but really be in the very worst. Joints in the lower chord of such bridges are seen to be pulling out by the locks splitting off. In such cases when the timbers are sounded with a boring bit the latter will find sound wood for 2 or 3 in., when suddenly the bit may take a jump of 4 or 6 in. through a dry rot hole. Such well-covered and well-appearing bridges are found not to have been covered under about three years after building. Equally good uncovered bridges, even better, ten

* Extract from a paper read at the annual meeting of 1881 of the American Society of Mechanical Engineers.

years old, have been found than those of equal age, well covered, in which the covering was delayed three years. It appears that after three years of exposure to open weather a bridge is doomed to a life of only about ten years, covered or uncovered.

But by prompt covering of wooden bridges the life is more than doubled, from which it appears that the practice of covering such bridges is highly economical.

It is sometimes the practice to cover simply the trusses, and it is necessary in "half Howe" or "pony" trusses of wood. This leaves the floor system exposed, and any sap wood about the floor-beams or the stringers is soon eaten away with decay. Sap is of but little worth after three years exposure, even when free. But heart wood is often perfectly sound at ten or fifteen years. Sap wood is so comparatively worthless that some engineers specify that not over 8 per cent. of section of timbers shall be sap. It is an excellent precaution to thus limit the sap wood, because it is practically of no value. In existing bridges sap wood rot has reduced the section of chords, as estimated, from 10 to 20 per cent., the remainder being sound. Uncovered flooring, should, therefore, be watched, and when the beams are found weak, as by observed excessive deflection, new beams should be added.

Painting is an excellent practice, and its power for prolonging the life of wood is not confined to free or external surfaces, but internal as well,—that is, to illustrate, lower chords have been examined where the wooden "clamps and keys" were laid in white lead, or sometimes in red lead, and such are sound and strong to a greater age than unpainted.

A close joint in wood, where exposed, is far worse than open joint of small space sufficient for air to pass From this fact it appears that wood contracts have been avoided by using iron "clamps and keys" in lower chords. Some engineers make iron clamps or blocks with a space for ventilating between wood and iron, the bearings being quite narrow. These have given good results, and point to the value of ventilation.

As to ventilation in general, all coverings should leave the main bridge timbers free for air to circulate about them. For instance, the boarding along the sides of trusses should be firred out by girt strips being nailed to the truss along the braces above the lower chord and below the upper chord, and not on the chords themselves. Then, when the boarding is nailed upon these girts, it stands out free, so that air can freely go all about the chords.

In some instances chords have been found covered with tin, the same being fitted about the braces and nailed to the chords, so as to appear like giving protection to the chords beneath. But this is believed to be worse than no covering whatever, from the simple facts that, first, water will work in at the numerous joints; and, second, be held there by the tin covering. If the tin could be carried away from the wood by a 2″ space, the latter being allowed for ventilation, it will serve a good purpose when it is made tight. These conditions are really met in "combination" bridges; that is, in such as have wood upper chord braces and end posts, but with iron ties and lower chords. The upper chords are readily covered with tin, because nothing protrudes above to prevent. The braces, or vertical pieces generally, do not need covering, as it is found that the wet so rapidly escapes as to leave the braces soon dry.

Special pains should be taken to keep wet out of close places in wood. For instance, in deck bridges (Howes), water is apt to leak through the roof, as it is difficult to lay a roof among the ties, floor-beams, string, etc., in the floor system and get it tight. In such cases the sway braces are apt to carry the water which falls upon them down upon the lower chord. This has been avoided very neatly, cheaply, and efficiently on the Lake Shore & Michigan Southern Railway, by making a saw cut across the top and edges of the sway braces, and driving in a collar of sheet iron or tin, which extends down like spurs below, and thus heading off any water which may find its way through the floor or roof above, and alight upon the sway brace to come trickling down upon the lower chord.

But though tin may be suitable to cover upper chords as above explained with reasonable durability, yet as a main roof covering over the tops of Howe bridges it appears to be utterly worthless, for the reason that the sulphurous fumes of the smoke from the locomotive soon eats the tin roof through like a big pepper-box lid. Indeed this action has been observed upon heavier masses of iron than tin; the truss rods even having been observed in badly rusted or pitted condition, with a weakening of probably 5 to 10 per cent. The latter has been observed to be most serious in low lands, such as would be fregented by fogs. The moisture of the latter deposits upon the rods and absorbs the acids of the smoke. The iron is then etched more or less seriously. Rods for such localities should be made with some excess of section to provide for the corrosion.

WOODEN BRIDGES.

The prevailing wooden bridge is the Howe truss. It consists, as generally put up, of an upper and lower chord, connected by vertical tie-rods running through with nuts at both ends; the latter dividing the span into panels containing braces and counter-braces. The chords usually are made of four sticks, side by side, with blocks or "keys" notched in, but leaving a space between all the sticks. Chord bolts run through from side to side of chord to draw all together. In short chords the sticks run from end to end. But for lengths greater than about 40 ft., pieces are put in so as to break joints. In upper chords these simply abut against each other, but in lower chords clamps are used to made tension splices. These clamps are generally of oak wood; sometimes only one is used to a splice, but more often two, one on each side of pieces joined. A chord bolt goes through near each end of a clamp. The earliest point of failure in a wooden bridge is at the locks of these clamps, either on the clamp itself or on the interlocking hooks of the chord.

Two of these splices are never found opposite in a chord, but break joints, so as to allow one joint to each panel. In this way the so-called keys help to form the slice. There are always two main braces and one counter brace between in each panel. The former always incline toward the middle span point. In moderate spans there are always two tie rods at each inter-panel point, but in long spans there may be three at the ends of truss. The largest of these rods are 2 inches in diameter; almost always threaded without enlargement of ends. These ties draw against straps on the ouside of the chords, running from 1″ x 5″ down to ¼″ x 8″ in section, and long enough to extend the width of the chord. The braces almost always set square against iron angle blocks. The best of these blocks have flanges to prevent the braces from falling out of place. These blocks are often found broken, but the breakage is evidently due to carelessness in drawing up the tie rods too tight upon the braces, because on some roads these breaks are very numerous, while on others the same make of blocks are never found broken. Road-masters say they find difficulty in getting men to draw their ties up properly upon the braces.

The depths of these trusses vary. Short spans, or "pony" trusses, sometimes also called half trusses, run from about 8 to 12 feet height. Full trusses for longer spans are usually about 20 feet. The smaller trusses have about three or four floor beams per panel, while the larger have five. They always rest upon the chords.

When wooden bridges show signs of failure the speed of trains is often reduced till a remedy is applied, either in strengthening the bridge or by renewing it. Two ways of strengthening a lame bribge are in use. One consists of springing a wooden arch from the abutments, usually from iron skew backs, placed about 6 feet down, and rising at mid-span nearly to the tops of the trusses. Each case requires four arched ribs, one on each side of each truss. From the arches the trusses are suspended by rods. But this method is too expensive for an old bridge; it is more common for a light bridge otherwise good. The second way to doctor the bridge, and which is very common for old bridges, is to put a trestle bent under at the third or quarter span. A pile bent is sometimes used instead of a trestle bent. The objection to placing the bent at the middle is the fact that the counter-braces near the middle in that case become main-braces. Some less considerate road-masters place the doctor at the middle, however. But as the carrying power of a truss varies inversely as the square of the span, other things being equal, it appears that the strength of a bridge is nearly doubled by placing a support at the one-quarter point. Such trestle bents are carefully watched to guard against washing out by the stream. In high water such a trestle bent is a treacherous affair, a pile bent being far preferable.

The lateral bracing in bridges is almost always about the same, viz., about 6 + 6 braces and 1¼ tie rods, and the same from end to end of bridge. These are usually in the plane of the lower chords and also upper. No difference is made in the strength of the lateral bracing, as far as observed, for straight or curved track, though it is certain that the centrifugal force of a train running on the curved track over a bridge will give cause for lateral thrusts, which are considerably greater than for straight track. One element of compensation, however, exists in the fact that bridges under curved track are usually wider, so as to allow equal clearance room, and this gives wider lateral trussing. Trusses are not found inclined on account of curves on the bridge.

Through bridges of wood have no "sway" bracing. The chords of the trusses are from 24 to 30 inches in breadth, and the floor-beams extend entirely over to the outsides. This keeps the lower chord in position. The braces cover about the whole width of the chords, so that the trusses are quite stable in erect position.

Deck bridges always have sway bracing, but in some cases much stronger than others. Where several spans of wood bridges are contiguous, in some cases both or all are made continuous from span to span. In other cases only one chord will be continuous. Diagrams taken, as hereafter explained, have shown that in continuous two span bridges an appreciable rise of the second span occurs when the train gets fairly on the first.

THE CONSTRUCTION AND MAINTENANCE OF PUBLIC ROADS.

This is the title of one of the miscellaneous reports presented to both Houses of Parliament which go far to redeem the English Blue Books from being so much waste paper. The publication contains a number of reports from Her Majesty's representatives in the various European States, and will be valuable as showing the practice pursued in these various states for the construction and maintenance of the public roads. As we intend to abstract this report pretty freely, we shall not do more at present than call attention to it, and refer to its contents generally. The reports are, perhaps, more statistical than scientific, and more directly applicable to the question of how certain necessary moneys are obtained, thanks to the question of the size of the granite or other stones used. Such information as this would by itself be very valuable, inasmuch as it enables comparisons to be made; and if the cost of well-constructed and well-maintained roads in other countries can be shown to be less than the corresponding costs here, the matter should be fully considered. The question of cost depends on method or material. If good material is at hand, then, of course, the cost is comparatively small; but these reports, to have given the greatest interest, should have given more details as to materials used, how and whence obtained.

It will, perhaps, be best to take the countries somewhat in the order given. Thus:

Austria has roads both under and not under State control. The former are under the supervision of the Government, and the money required for them is stated in the Council Budget. The material used for mending the roads in Lower Austria is of a very inferior quality, so much so that some years ago a reward was offered for the discovery of some suitable and more solid substance, but without practical result. In Bohemia really good material (basalt) is obtainable, also in Moravia, Silesia, and the Tyrol, where granite, gneiss, and hard limestone are available. The total length of State roads is 15,275 kilometers, and a decree of 1843 ordered that these roads should have a maximum width of 9.48 metres (30 feet). More recently this has been increased to 12 metres.

The Austrian Government have of late paid much attention to the condition of the roads, and many systems have been tried for the improvement of their maintenance and repair. At one time most of the work was done by contract, various portions being let off on leases of nine years, the contractor receiving a certain sum for the material required, and also for the repair of the bridges; but the actual wages of the road-cleaners were paid by the Government. The fault of this system was that the road-cleaners, who were paid by the State, were dependent on the contractor for their places, and it was not possible to form any just estimate of the amount of work on the roads so many years in advance. This and many other contract schemes all proved unsuccessful, and the state roads are now entirely under the administration of the government and its duly appointed officials.

There are now 3,479 road-cleaners regularly employed on these roads, as, with a view to economy, their number has of late years been very much reduced, thus making the total length for which each one is held responsible amount to 4½ kilom. These men earn from 15 to 24 florins a month, and in the spring and autumn, when there is much heavy work on the roads, they are allowed a certain number of extra laborers. The inspectors have been reduced from 586 to 414, each having 36.32 kilom. in charge.

The technical method of repair now in use is generally acknowledged to be the most practicable and economical, and consists in the laying down of a large quantity of material on the roads in the spring and autumn, and in the continual repairing of all defects, and in the clearing off of all dust and mud by the road-scrapers. Another system that was at one time tried was the so-called "patch system" (*point-à-temps*), by which the roads had to be cleared of all dust and mud, the ruts, wheel-tracks, and other defects filled up with gravel, and the soil round the damaged part had also to be loosened and afterwards beaten together until a consolidation of the two parts was obtained, thus forming a smooth and even surface, with the

proper amount of slope required to drain off all wet.

The difference in these two systems is that the former requires a greater amount of material and the latter more labor, but it was found on trial to be far too costly, and that the use of the rollers necessary was in many cases attended with great difficulties, and also on account of the small number of roads constructed on the macademized principles, so the Government have now again returned to the former system.

The other roads are either provincial, district, or municipal, according as they are maintained by the province, a district committee, or a municipality. It will suffice if we refer to the districts.

In those provinces where district representative bodies exist, as in Styria, the Tyrol, Bohemia and Galicia, the district roads are under the direct control and management of the district committees; but in the other provinces committees, composed of from five to fifteen members, are elected for three years by the various districts according to their size and extent. The highest taxpayer, and also a member of the Permanent Committee of the Provincial Diet, are always appointed to serve on each committee, but no remuneration is made to any of the members for their services beyond a right to charge expenses.

The cost of maintenance and construction of these roads is provided for by rates levied in proportion to the amount of direct taxes paid by the inhabitants. These committees have the power to raise the tax up to 15 per cent. of the total amount of the above taxation, but should any further increase be necessary the consent of the Diet must be obtained. In the poorer districts, where, on account of the small amount of taxes paid, it is found impossible to raise a sufficient sum for the proper maintenance of the roads, assistance is given by the provincial government from a fund provided for that purpose; and for any special outlay, such as the construction of bridges, etc., advances or loans are often granted without any payment of interest. The cleaning and repairing of both the provincial and district roads is carried on by regularly appointed road cleaners, to whom certain portions of road, from two to four kiloms. in length, are allotted, and for whose maintenance and condition they are held responsible, a certain number of day laborers being allowed them, according as they may be required. The regularly appointed provincial or district road-cleaner earns from 20 florins to 30 florins a month, and has a claim to a pension when unable any longer to perform his duties. Technical engineers are also appointed for each district by the provincial government to inspect and superintend all works of importance, such as the renewal or construction of roads and bridges.

The provincial and district roads ought, according to law, to be constructed on the macadamized principle, and with a breadth of 6 metres, not including the space necessary for ditches or for the planting of trees. The macadamizing of the center part of these roads consists in laying a foundation of broken stones of a depth from 15 to 20 centim., with a covering of 15 centim. of gravel, and with an incline of 1 in 18; but owing to the great expense involved in this process, it is only adopted in the construction of new roads, or those where the traffic is very heavy, the older roads being almost all constructed without the first layer. The planting of all provincial and district roads with tress at a distance of 20 metres apart is also legally authorized. The construction and reconstruction of bridges, canals and dykes is carried out in as solid a manner as possible, the older ones being now replaced by those of stone, brick, and iron, and where the safety of the traffic requires it, large curb and corner stones are placed.

A special class of district roads must also here be mentioned, viz.: those leading to railway stations or large industrial establishments, the cost of maintenance and construction being in general divided between the persons interested. Turnpike charges have, since the year 1870, been abolished on the provincial, but still exist on many of the district and municipal roads, and tolls are often levied for the maintenance and repair of bridges.—*The Contract Journal of London.*

MERIDIAN LINE.*

The following process has been used by the undersigned for many years. The true meridian can thus be found within one minute of arc:

Directions.—Nail a slat to the north side of an upper window—the higher the better. Let it be 25 feet from the ground, or more. Let it project about three feet. Near the end suspend a plumb-bob, and have it swing in a bucket of water. A lamp set in the window will render the upper part of the string visible. Place a small table or stand about 20 feet south of the plumb-bob, and on its south edge stick the small blade of a pocket knife; place the eye close to the blade, and move the stand so as to bring the blade, string, and polar star into line. Place the table so that the star shall be seen very near the slat in the window. Let this be done half an hour before the greatest elongation of the star. Within four or five minutes after the first alignment the star will have moved to the east or west of the string. Slip the table or the knife a little to one side, and align carefully as before. After a few alignments the star will move along the string—down, if the elongation is west; up, if east. On the first of June the eastern elongation occurs about half-past two in the morning, and as daylight comes on shortly after the observation is completed, I prefer that time of year. The time of meridian passage or of the elongation can be found in almost any work on surveying. Of course the observer should choose a calm night.

In the morning the transit can be ranged with the knife blade and string, and the proper angle turned off to the left, if the elongation is east; to the right, if west.

Instead of turning off the angle, as above described, I measure 200 or 300 ft. northward, in the direction of the string, and compute the offset in feet and inches, set a stake in the ground, and drive a tack in the usual way.

Suppose the distance is 250 ft. and the angle 1° 40′, then the offset will be 7.271 ft., or 7 ft. 3¼ in. A minute of arc at the distance of 250 ft., is ¼ of an inch; and this is the most accurate way, for the vernier will not mark so small a space accurately.

ANGLE OF ELONGATION.

This should be computed by the surveyor for each observation. The distance between the star and the pole is continually diminishing, and on January 1, 1882, was 1° 18′ 48″. There is a slight annual variation in the distance. July 1, 1882, it will be 1° 19′ 20″. If from this latter quantity the observer will substract 16″ for 1883, and the same quantity for each succeeding year for the next four or five years, no error so great as one-quarter of a minute will be made in the position of the meridian as determined in the summer months. If winter observations are made, the distance in January should be used. The formula for computing the angle of elongation is easily made by any one understanding spherical trigonometry, and is

$$\text{this:}\ \frac{R \times \sin.\ Polar\ dist.}{\cos.\ lat.} = \text{sin. of angle of elongation.}$$

As an example, suppose the time is July, 1882, and the latitude 40°. Then the computation being made, the angle will be found to be 1° 43′ 34″. A difference of six minutes in the latitude will make less than 10″ difference in the angle, as one can see by trial. Any good state or county map will give the latitude to within one or two miles—or minutes.

The facts being as here stated, the absurdity of the Ohio law, concerning the establishment of county meridians, becomes apparent. The longitude has nothing at all to do with the meridian; and a difference of *six miles* in latitude makes no appreciable error in the meridian established as here suggested, whereas, the statute requires the latitude within *one-half a second*, which is *fifty feet*. There are some other things, besides the ways of Providence, which may be said to be "past finding out." It is not probable that a surveyor would err so much as *three* miles in his latitude; but should he do so, then the error in his meridian line, resulting from the mistake, will be *five seconds*, and a line *one mile* long, run on a course 5″ out of the way, will vary but *an inch and a half* from the true position. Surveyors well know that no such accuracy is attainable.

R. W. McFARLAND.

*From Proceedings of the Association of County Surveyors of Ohio at its third annual meeting held in Columbus in January last.

LITERATURE.

LOCAL GOVERNMENT IN NEW YORK, BY E. W. BEMIS.—The management of local affairs in New Netherlands was in the hands of village magistrates nominated by the people and confirmed by the Governor. With the influx of immigrants from New England, after the conquest of New Netherlands by the English in 1664, came important modifications of the Dutch system of local government. In 1684, New York was divided into counties. This English unit of administration still obtains an important place in the local autonomy of the above State. The county is composed of towns from thirty to sixty square miles in area. Powers of county legislation are invested in county boards, consisting of the supervisors or heads of the several towns forming the larger unit. The county boards issue warrants for the collection of all taxes in support of roads, bridges, erection of court-houses and other county purposes. Town assessors report to the county authorities. All purely local officers are elected by the towns in town meeting assembled. The towns can make by-laws and establish penalties for local offences; they can regulate their own common schools, common lands, fences and town property; they can raise money by local taxation for public uses, such as roads and bridges, if more than the county allowance is needed. The distinguishing feature of the New York system of local government, as compared with the New England system, is the great power of the county in the control of its towns. New York has a compromise system, combining the best features of the New England town and of the Southern county. From the New York system has developed that of Illinois, Michigan and Wisconsin.

LOCAL SELF-GOVERNMENT IN PENNSYLVANIA, BY E. R. L. GOULD.—In early colonial times, under the administration of the Duke of York, the town or parish was the center of local life. County government did not practically exist. All town officers were under the management of a constable and a board of overseers, who promulgated constitutions and by-laws and adjudicated petty cases in the "Towne Court." This body also looked after the ecclesiastical interests of the parish. The local administration of this period was essentially a reproduction of the English system. In the early stages of proprietary rule the town lost its former position and the county became most prominent. The County Court of Quarter Sessions was the center of authority, and rates were levied, roads opened, bridges constructed, and the poor cared for under county direction. Subsequently the charge of paupers and highways was transferred to the township, on which the overseers and supervisors laid rates to cover expenditure entailed by these burdens.

The Pennsylvania system at the present time is a compromise between the town polity of New England and the county administration of the Southern States. The system aims at a partition of powers. There is no town meeting where the people may come together and frame by-laws for their own government. Neither is the township represented by a supervisor upon the County Board as in New York, Michigan, Illinois, and other of the Northern and Northwestern States. The township officers have the power to levy a road tax, but only on the basis of the last adjusted county valuation. County assessments are made to defray the ordinary expenses of local government. The poor are usually, though not always, a county charge, and when such is the case are supported from the general county fund. The county is the leading local unit and, under the commonwealth, may be said to wield the largest share of political power. It regulates affairs directly and its officers are responsible to the people for the exercise of administrative control. [This paper was read before the Pennsylvania Historical Society, May 1, 1882, and is now in press.]

LOCAL SELF-GOVERNMENT IN ILLINOIS, BY ALBERT SHAW.—The local institutions of the West are not novelties nor experiments. In main features they reproduce those social arrangements under which the Anglo-Saxon insists upon living, wherever he may be transplanted. Illinois may be taken as the model western State in respect to local government. The precise form which its institutions have assumed has been largely shaped by the State's history. Illinois illustrates the tendency of migration to follow the parallels of latitude. Its southern half was peopled from Southern States, especially Virginia, while men from New England and New York occupied the northern half. The settlers brought their ideas and habits with them. The New England men came from self-governing agricultural communities, where the people made laws, chose officers and voted local taxes in the democratic "town meeting." The New England county was little more than a name; the township was the real political unit. The Virginia settlers, on the other hand, had not been accustomed to organized neighborhood life or to local self-government. In the States of the South, county officers appointed by the State government administered State laws.

Illinois passed from French to English hands in 1763 and was in 1778 made a Virginia county. A decade later it passed under the government established by the ordinance of 1787, which confirmed forever to the people many great principles. In 1818 it was admitted as a State. Its early connection with Virginia, as well as the temporary government erected under the ordinance, had already given a Southern cast to its administrative forms. The southern half of the State alone being settled at the time of its admission to the Union, the Constitution of 1818 naturally provided for a county system similar to Virginia's. Southern migration to Illinois declined after the Missouri Compromise of 1820 and Northern people filled up the State. The new Constitution of 1848 compromised with the two systems of local government by providing that counties might, on popular vote, be placed under township organization. The northern counties at once adopted the township system, southern counties remaining under the county system. At the present time about four-fifths of the 102 counties in the State are under township government. This result was materially furthered by the United States Land Survey System, which

divided the public domain into townships and allotted land in each township for school purposes.

The annual "town meeting" of the whole voting population is the central fact in township government. At this meeting the people elect local officers, discuss neighborhood interests, vote taxes and enact by-laws and rules covering a wide range of local topics. The supervisor is the business officer of the township, and the supervisors of the several townships constitute a County Board which manages county affairs. Highways and schools are provided for by the townships, while the care of the poor is entrusted either to the county or the townships as the people may determine. Each township elects two justices of the peace. The county maintains a judicial establishment and controls matters which concern the townships in common. As in the South, so in Illinois and throughout the West the county is the political unit within the State. General laws provide for the incorporation and municipal government of "villages" and "cities," requiring a minimum population of 300 for the former, and of 1,000 for the latter. The compass of this abstract precludes details of county, township and municipal governments as provided for in the statutes of Illinois.—*Johns Hopkins University Circular.*

NOTES.

COMPOUND LOCOMOTIVES.

The gradual encroachment which steam is making upon the ocean carrying trade is due in great part to the cheapness with which the adoption of compounded engines enables steamships to carry freight. There is some prospect that the same principle may be applied to land carriage, as an Englishman, Mr. E. W. Webb, Superintendent of the London and Northampton Railroad, has invented what he names a "compound locomotive." Its purpose is to economize fuel by the use of both high and low steam. There are two sets of driving wheels, which are not connected, but each set is driven by independent engines. The steam is first received under high pressure in two cylinders placed on each side of the boiler, and about half way back. The pistons of these work the rear drivers by direct motion. The steam from them is then exhausted into pipes which are conducted in front of the boiler flues to keep the steam hot, and then into one large cylinder located directly under the front of the boiler. This cylinder carries, by a shaft under the boiler, the forward drivers. The new locomotive has run 5900 miles in the "Irish Mail" service, and the consumption of coal has only averaged 22¾ pounds per train mile, including that required to get up steam—a saving of over 25 per cent. upon the ordinary requirements.

TERRIFIC FORCE OF CLOUD WATER.

During the past week there have been half a dozen cloud-bursts in various sections in the eastern part of Nevada. The boss "burst" would seem to be that which occurred last Sunday in the mountains east of Oreana, and which swept away a stone railroad culvert 30 ft. wide and 20 ft. deep. An eye-witness asserts that the current of air created by the large body of water would have drawn a person into it from a distance of 20 ft. Steel rails weighing 60 pounds to the yard stood on end like telegraph poles, and the solid stone masonry work of the culvert was swept away like so much rubbish. It is imposible to estimate the wonderful velocity this body of water had reached when it came upon what was almost a solid stone barrier. It was like the stroke of a battering ram.—*From the Virginia City Enterprise.*

GENERAL INTELLIGENCE.

☞ *We solicit and are always pleased to publish in these columns any items of interest that may be furnished us.*

GAS AND WATER.

WATER-WORKS TO BE BUILT.—Messrs. Goodhue & Birnie, of Springfield, Mass., will commence next week on the construction of water-works at Spencer, Mass., a manufacturing town of 9,000 inhabitants; cost of works about $150,000; gravity system; source of supply, Shaw's Pond, 175 ft. above the main street in Spencer. Town will pay $50 per annum per hydrant to the company, who build and own the works, Messrs. Goodhue & Birnie being the principal stockholders. There will be 14 miles of pipe from 4 in. to 16 in., wrought iron, cement lined, manufactured by the contractors. Hydrants will probably be of Pattee & Perkins, Holyoke, make, and valves from Chapman Valve Co. The contractors intend to get the water on this year. Messrs. Goodhue & Birnie are putting in a new 18 in. pipe in addition to the old 14 in. pipe found insufficient for the town of Concord, N. H.; contract price, $44,600. They have also just completed water-works at Lee, Mass., and are making extensions at Waltham and Nantasket Beach, Mass. Messrs. Goodhue & Birnie report plenty of business throughout New England.

CLEANING THE TORONTO RESERVOIR.—The reservoir at Rose Hill is now being cleansed, the water having been left off a few days ago. It is not in a very filthy condition, the principal accumulation since last cleaning being a small quantity of *debris*, deposited mud, and a few vegetable growths. The city is now supplied with water being pumped into the large mains direct to supply the demands. The cleaning operations will be completed to-day.

ATLANTIC, La., is to have water works that will cost $62,000.

THE CITY OF ORANGE, N. J.—The city of Orange is to be supplied with water by damming a natural basin at Milburn and conveying the water in pipes by its own gravity to a reservoir near the city. A daily supply of 1,700,000 gallons can thus be obtained at a cost of $400,000, which includes land and all expenses of construction, &c. It is calculated that the system will give a head of 88 feet above the highest point in the city.

BRUSH VALLEY (PA.) WATER WORKS.—We have received the following note from this place: The Locust Mountain Water Company is constructing water works here to supply the towns of Mount Carmel, Centralia and the surrounding collieries. The works in course of erection consist of an embankment 900 ft. long across the valley, forming a lake about 25 acres in extent. The overflow will be a crib dam, 50 ft. in length, built over the present site of Roaring Creek. The water will be pumped through a 20 in. pipe to the top of Big Mountain, to a point 650 ft. above the present level of the creek, by means of two Worthington compound duplex pumping engines, one at the lake and the other half way up the mountain. From the top of Big Mountain an 18-in. line runs for about one mile and a quarter to a distributing reservoir capable of containing about 30,000,000 gallons. There pipe lines of various diameters will convey it to the collieries and towns. It is proposed to complete the lake supply line and distributing reservoir by December next, leaving the distributing lines to be built next year. The contract has been awarded to Mr. C. S. Nesbit, of Montana City, Pa. The Chief Engineer is Mr. T. S. McNair, of Hazleton, Pa., and the work is in charge of Mr. Wm. Seemuller, late of the Baltimore water works.

ARTESIAN WELLS.—The artesian well bore is now down 1740 feet, and the drill is still working in very hard rock. The character of the formation has changed within the last day or two, and the present rock is believed to be Trenton limestone. Certainly the lime is very prominent in it. The approximate thickness of this limestone is placed in White's geology at 200 feet. Below this, in the natural order, should be St. Peter's sandstone, and when that formation is reached the company hopes to meet its ample reward.—*Sioux City (Iowa) Journal.*

INCREASE OF CAPITAL.—The gas company at East Hampton, Mass., has voted to increase its capital stock from $25,000 to $30,000, and to build another gas holder.

NEW WATER-WORKS.—In a letter from Clinton Rice, of the *Railway Age*, headed Rincon, N. M., we find the following item in regard to Lake Valley, N. M.: "The Lake Valley Water-Works, also working under and controlled by the same parties, commenced operations simultaneously with the mill and reduction works. By its operation fresh, pure water from a lake on the old McEver's ranch is conveyed a distance of four miles to Lake Valley and the mills, with a capacity of 600,000 gallons per day."

THE NEW FISHKILL (N. Y.) WATER WORKS CO.—The name of the company is the Highland Water-Works Company; capital stock $100,000; incorporators, Lewis Tompkins, Willard H. Mase, H. A. Alden, C. M. Wolcott, C. L. Kimball, S. G. Smith and James Mackin. The company propose to obtain a supply from the following sources: From the Fishkill Creek above all sources of pollution; from the "Trout Brook," so called, flowing into the Fishkill Creek on the east, a short distance above Matteawan; from the stream or brook flowing into the Fishkill Creek on the east, near the village of Fishkill; from the reservoir formed by the erection of a dam or dams on or near Gut Pond, so called, in the town of Pleasant Valley; from the reservoir formed by the erection of a dam or dams, and the consequent storing of waters in Little Pond, so called, in the town of Fawling; from the various streams, brooks or creeks tributary to the Fishkill creek.

WORK on the Hagerstown, Md., water-works has been temporarily suspended until after harvest.

THE TRIAL of the Milford, Mass., water-works hydrants will take place to-day at 1 P. M. This trial is preparatory to the acceptance by the town of the hydrant service.

EXTENSION OF WATER-WORKS—The citizens of Constantine, Mich., have voted $11,000 to extend their water works.

PLANS FOR EASTHAMPTON, MASS., WATER-WORKS.—Engineer E. C. Davis has completed the plans for the proposed water-works from Turkey Brook. By them it will be necessary to lay some 4¾ miles of main pipe, 12-in. cast-iron pipe being recommended, though different thicknesses will be required as the pressure varies, and the pipes will be very heavy in the meadows near the village. The cost, including reservoir, gate-house and main pipes, will be about $60,000. Other expenses will be land damages, which cannot be much, as the pipe will run in the highway for a long distance, right of way and damage to mill owners. Under the latter will come all the mill owners below Loudville on the Manhan River, but it would not effect the water privileges of the mills in the village as the water would go back into the stream again. Mr. Davis advises building several small reservoirs on the stream, and thus keeping the water moving, rather than one large reservoir. He advises taking more thorough measurements while the water is low in the stream this summer, but thinks the supply will be ample.

WILL BUILD WATER-WORKS.—The city council of Grand Forks, Dakota, has approved of having city water-works. The mains will cover the greater portion of the city, and the people will vote for or against the raising of $15,000 for the purpose.

PALATKA, Fla., will be supplied with water from artesian wells.

THE WEST CHESTER, Pa., water-works are to be enlarged.

ELECTRICITY.

KEOKUK AND NAUVOO, Iowa, are connected by telephone.

ELECTRIC LIGHT AT TIPTON, IOWA.—Towers 150 ft. high are being erected, from which will be displayed electric lights for the illumination of the town.

ELECTRIC LIGHT AT FOND DU LAC, WIS.—Under contracts authorized by the Common Council it is proposed to light the city about Sept. 1 with electric lights from six towers. The towers are to be erected upon public buildings at a cost of about $3,400, and are to be the property of the city, while the lighting of the lamps, furnishing "the plant," and the power for running the same are to be done by contract for five years at $5,500 per year. The Brush system is the one adopted, and the whole scheme is subject to rejection by the Common Council on 60 days' trial.

ELECTRICITY is applicable to a variety of uses in connection with railways. On the Eastern Railway of France recently, experiments were made with a train having an electric brake, electric communication between the carriages, and electric lamps in each compartment of the thirteen vehicles. If the train had been drawn by an electric motor, as it may be some day, the adoption of the electric fluid to the purposes of locomotion would apparently have been complete.—*Exchange.*

TESTING AN ELECTRIC SIGNAL.—The New York, Lake Erie and Western Company is testing a newly-patented electric signal at the eastern junction of the Bergen County Short-cut with the main line. A magnet is set alongside the track of the Short-cut fifteen hundred feet from the junction, which, every time a car wheel passes over it, rings a telephone bell at the junction. This warns the watchman posted there that there is a train coming on the Short-cut, which is to go on the main line, and he sets the signals and switches accordingly. There is another arrangement which causes an automatic red danger signal to appear on the Short-cut whenever there is a train on the main line approaching the junction from either direction. The signal has been found very useful there, as there is a short curve and a hill which cuts off the view between the main line and the Short-cut beyond, a distance of a few rods on the latter. Thus far it has worked like a charm.—*Middletown (N. Y.) Press.*

THE CABLE from Galveston to Vera Cruz has been completed. This puts Galveston in direct communication with the whole of South America.

TELEPHONES number 192 in Jackson, Mich.

RIVERS AND HARBORS.

TORONTO HARBOR.—The Dominion Government Engineer, Mr. Perley, has had plans and specifications prepared for the projected improvement of Toronto Harbor, by the construction of extensive works at the Island. When these improvements are completed the navigable entrance through the eastern gap will be 500 feet in width, and deep enough to allow the entrance to the harbor of the largest lake steamers. The western channel will also be protected from the encroachments of the sand, which has been rapidly forming a dangerous bar between the Queen's wharf and Hanlan's Point. The works at the eastern part of the Island will make the dwellers thereon feel secure in their houses, and no danger to the central part need be again apprehended. The projected works will be pushed forward without delay.

STREETS, DRAINAGE, ETC.

MILWAUKEE PAVEMENTS.—The Board of Public Works desired to pave certain streets with Waterloo stone, but the Aldermen decided to lay cedar blocks. In about one year after the work has been finished the Aldermen will, in all probability, be convinced of their error.

CEDAR BLOCKS.—The Common Council of Minneapolis recently passed a resolution to pave a certain business street with cedar blocks, "laid upon a suitable foundation." This was vetoed by the Mayor, who advocated granite. The resolution was passed over the veto, and now another city will become wise by experience, and will pay dearly for its tutoring.

TUNNELS.

MULLAN TUNNEL ITEMS.—The difficulty of draining the deep cut on the other side of the mountain has been overcome. The work of getting the air compressor into order is being rapidly pushed forward, and will be ready as soon as the shaft is completed, which will be in the early part of next month. When the shaft is sunk to the depth of 140 ft., tunnelling will commence in both directions, and also at the same time from the west end of the tunnel toward the east. The Northern Pacific Railroad survey party is cross-sectioning and a half mile below the Eleven-Mile House, and has yet a considerable amount of rough work ahead of it, especially through the canon.—*Helena Herald.*

CANALS.

POSTPONEMENT OF CANAL CONTRACTS.—The Department of Railways and Canals, Ottawa, Canada, has postponed the letting of the works for the Fenelon Falls, Buckhorn and Burleigh canals, advertised to take place on July 5, until Wednesday, Aug. 2 next. Plans, specifications, etc., will be ready for examination (at the places previously mentioned) on Saturday, July 15 next.

PUBLIC WORKS TENDERS.—The real object of the government in making a show of proceeding with so many public works just on the eve of the general elections is now being shown. In few, if any, of the cases in which tenders were called for is the work ready to be proceeded with. The time of reception of tenders for the construction of the Cornwall post-office has al-

ready been extended, and now the reception of tenders for the Trent Valley works has been postponed from July 5 to Aug. 2. A similar postponement in other works advertised may be looked for.—*Toronto Globe.*

RAILROADS.

THE NATIONAL RAILWAY.—The Chairman of the House Committee on Pacific Railroads has reported to the House of Representatives a substitute for the original bill proposing the incorporation of the National Railway. This substitute authorizes the company to build a railroad from Washington to the Hudson River opposite New York, and grants to it the power to appropriate lands for the construction and operation of the road so as to include the lands necessary for depots, wharves, etc., within the City of New York and Jersey City. It limits the first-class passenger fare from Washington to New York to $5; provides that the charter shall not be sold, transferred or assigned to any person or corporation, and directs the company to begin the construction of the road within twelve months after the passage of the act. In consideration of the power proposed to be granted to the incorporators, the bill provides that the United States mails shall be transported by the company on its through fast trains between Washington and New York in "not to exceed 6 hours and 30 minutes per trip, for such compensation as the Postmaster General may deem just and equitable." The incorporators named in the bill are John B. Gordon, Joseph A. Jameson, Hugh McCulloch, William A. Wallace, H. M. Hutchinson, George K. Chase, Noah L. Jeffries, John A. J. Creswell and A. E. Davis.

NEW ILLINOIS RAILROAD.—Articles of incorporation of the Carbondale Connecting Railway Company were filed June 24, in the office of the Secretary of State. The object is to build a railroad from Carbondale to connect with the Carbondale & Shawneetown and Illinois Central Railroads. The capital stock is $10,000.

A NEW ROAD.—A new railroad is to be constructed at once from East St. Louis to Chester, Ia., following the bluff through Monroe and Randolph Counties. Men are already engaged in securing the right of way along the proposed route.

STREET RAILROAD.—A street railroad company has been organized at Centerville, Iowa, and incorporated for the purpose of building and operating a street railroad from the Rock Island Depot to the square.

OREGON SHORT LINE.—The Oregon Short Line, now being constructed by the Union Pacific, will open up a new line of travel to the Pacific coast. It leaves the Union Pacific at Granger, Wy. T., 877 miles west of Omaha, and runs nearly in a direct line to Oregon, and will reach Baker City, Or., from where it will have a connection with Portland, over a road being built eastward. On the Oregon Short Line the track is laid for 150 miles, and the road will cross the Utah and Northern 215 miles from Granger. On the 8th inst., rails were laid on the bridge over Snake River at American Falls, and for 2,000 feet beyond that point, and the daily rate of progress since that date has been 1¼ miles. At this rate the rails will undoubtedly be laid to Little Wood River in 60 days. The road will be opened for traffic as soon as the distance between Granger and the crossing of the Utah Northern is covered by the rails.

THE SAUK CENTER (MINN.) NORTHERN.—Iron has been laid to the crossing of the Little Falls and Dakota road. The grading on this line was begun only three weeks ago, but it has been pushed with unusual vigor. The road will be completed in time to move this year's crops from the Eagle valley if the weather continues favorable.

NEW SOUTHERN ROAD.—Articles of incorporation for the Pensacola & Mobile Railroad were filed in the office of the Secretary of State at Montgomery, Ala., a few days ago. The road is designed to run from Tensas, on the Mobile & Montgomery road, to Muscogee mills, on Perdido River, where it will connect with a branch already running out from Pensacola.

WORK BEGUN.—Work was commenced June 26 on the branch road designed to connect the Memphis & Little Rock road at Forest City with the Iron Mountain at Knobel Station. The contract calls for completion by Oct. 1.

WORK on the Louisville and St. Louis Air Line Road is progressing very rapidly, and by August 1st it will be ready for operation.

COMPLETING THE SURVEY.—FORT WAYNE, Ind., June 26. Surveyors will arrive here this week for completing the survey of an Air Line Road from Columbus to Fort Wayne, to be built for the purpose of bringing coal from Ohio mines and to take eastward Michigan lumber shipments.

CONSTRUCTION WORK.—Reports received here yesterday state that the grade in the main line of the Chippewa Valley and Superior Road, as well as the bridge work, will be entirely completed by Thursday of the present week. The track is now within five miles of Reed's Landing, the western terminus. The branch from Durand to Cedar Falls, a distance of twenty-two miles, is well along, and the contractors expect to complete the grading work by the 10th of July. The contractors, Wells, Harrison & Green, who also have charge of the construction work on the Toledo and Northwestern branch of the Chicago and Northwestern Road, projected to run from Eagle Grove to Alton, on the Chicago, St. Paul, Minneapolis and Omaha Line, state that the grade will be finished August 1st. The track-laying has progressed as far west as Peterson, eighty-three miles west of Eagle Grove. They also state that four hundred men and two hundred teams are at work between Schleisingerville and Neenah. This force is being augmented as rapidly as the right of way is being secured. Condemnation proceedings have been begun in many cases.—*Milwaukee Republican Sentinel.*

INCREASING ITS CAPITAL.—The Rio Grande and Pecos Railroad company has filed a resolution of the stockholders increasing the capital stock to $20,000,000.

THE ST. LOUIS & CHICAGO.—The Cincinnati, Indianapolis, St. Louis and Chicago management has decided upon extensive improvements in the valley of Tanner's creek, the scene of the late disastrous wash-outs. In addition to relocation of portions of the track, the road-bed over a distance of 14 miles will be raised from 5 to 10 ft. where necessary, in order to get out of reach of the freshets. The damage done recently will reach at least $100,000, according to Supt. Sherwood's estimate. The right of way for the relocated line has been secured by condemning needed property.

THE EUREKA SPRINGS (ARK.) ROAD.—Officials connected with this road are actively engaged in getting a full force of graders, masons and other workmen in readiness to push the work with all possible vigor, so as to complete the line at an early day.

THE MISSOURI PACIFIC BOARD.—A consolidated mortgage bond given by the Missouri Pacific Railroad to John F. Dillon and E. D. Ames, as trustees, has been put on record in Atchison County, Kansas.

THE NEW YORK, WEST SHORE & BUFFALO railroad has issued orders to all the contractors along the line that their work must be completed by November 1 next. It is stated that there are at present employed on West Shore work 35,000 laborers, nearly 800 civil engineers, 600 steam drills and 21 locomotives, at a daily expense of $100,000.

TO LAY RAILS.—The Milwaukee & Lake Winnebago Company will commence laying rails between Neenah and Schliesingerville next week.

THE COUNCIL BLUFFS LINE.—The track of the Council Bluffs division of the Milwaukee & St. Paul entered Manning, Tuesday. Two miles a day are being laid from the east, and one from the west, and in about ten days the new trunk line across Iowa will be completed. The road is rapidly being pushed in first-class condition, and the ballasting will be mostly finished by the 1st of August. Grading will be commenced on the Defiance line to Sioux City in a short time.

HEADING FOR THE TURTLE MOUNTAINS.—A note from Larimore, D. T., says: "The work of grading the Manitoba line from this place to the Turtle Mountains has been commenced in dead earnest by Langdon & Co., contractors. They already have a large force of men and teams on the ground, and more are arriving on every train. They have erected a large supply store here, and will make this their headquarters for the summer."

CONTRACTS ON THE W., I. & N. ROAD.—Superintendent Woolston, on his return to Marshalltown, Ia., from New York, was authorized to let contracts for grading and bridging 100 miles of the Wisconsin, Iowa & Nebraska road.

CONTRACTS LET.

WORK ON GOVERNMENT BUILDING AT PHILADELPHIA.—Supervising Architect Hill has let the contract for iron-work, furring and lathing to J. W. Hoyt of Springfield, Mass., for $34,000. There were 12 bids, the highest being $12,000.

A CHICAGO CONTRACT LET.—The contract for the foundations of the new Board of Trade building was awarded to E. Sturtevant, for $18,975. The Board furnishes the timber and broken stone and cement for the concrete. The contractor furnishes the sand and 26,000 cubic ft. of dimension stone and does all the work, which he agrees to complete in 36 working days. There were fourteen bids, ranging from $27,000 to $18,300. The latter figure would have been accepted, but the contractor declined to bind himself to complete the work in the time specified.

A STONE CONTRACT LET.—PRAIRIE DU CHIEN, Wis., June 21.—The largest contract ever entered into in this section was concluded in this city yesterday evening between Edward Darragh, contractor, and Col. Smith, chief engineer of the Minneapolis Union stone arch bridge, and Thomas Marsden of Bridgeport, this county. The conditions of the contract are that Marsden shall furnish the stone necessary so that five or more car loads each day will be loaded for shipment at the quarry until December 15th next. The stone from this quarry is of the quality known as the Wisconsin River marble, and is the best in the country for building purposes.

STREET CONTRACTS LET.—A dispatch from Toronto says: The following tenders for roadways were accepted, and the contracts awarded: Lingard street, A. W. Godson, at the annexed terms: pavement per yard, 95c.; curbing per ft., 25c.; cast-iron platforms, $2.28 per 100 lbs. Harbord street, R. Dennis, pavement per yard, 99c.; curbing, 27c.; cast iron, $2.50. Henry street, Ardagh & Leonard, pavement, 95c.; curbing, 27c.; cast iron, $4; sidewalks, $23 per 100 ft. Bellevue avenue, also Ardagh & Leonard, pavement, 95c.; curbing, 25c.; cast iron, $4. Parliament street, A. W. Godson, pavement, $1.22; curbing, 25c.; cast iron, $2.25; railway track, $20 per 100 ft.

JAIL CONTRACT LET.—The following bids were received for the erection of a county jail at Maysville, Ky., on June 22: Julian W. Hinkle, of Indianapolis, Ind., $31,700, yard wall at $9 per lineal foot; Crumbo & Melcher, of New Albany, Ind., $40,290.80, yard wall, $13.30 per lineal foot; I. M. Lam & Co., of Maysville, Ky., $45,996, yard wall, $18.50 per lineal foot; E. J. Hodgson, of Indianapolis, Ind., $32,200, yard wall at $8 per lineal foot. The contract was awarded to Mr. Hodgson.

JAIL CONTRACT LET.—The contract for the new jail and jailors' residence at Jackson, O., has been let, Edward F. Mitchell getting the iron work for $9,800, and W. W. McCoy, of Marietta, getting the stone and brick work for $10,100.

BIRMINGHAM, Ala., is to have another compound condensing pumping engine from the George F. Blake Manufacturing Company, a contract having been signed last week for the duplicate engine.

STREET-CLEANING JOB IN BUFFALO.—BUFFALO, June 26.—Mayor Cleveland to-day returned to the Council, with a severely-worded veto Message, the resolution recently adopted by that body to award the street-cleaning contract to a bidder at $109,000 above the bid of other responsible parties. The contract was then awarded to the lowest bidder.

THE HINSDALE (MASS.) BRIDGE COMMITTEE has contracted with Whitlock & Power, of Hudson, N. Y., for an iron bridge to cross the river between F. B. Cook's store and the post-office. It will be 62 ft. span, with 18 ft. roadway, and two sidewalks 5 ft. wide, and will cost $1,500. The abutments are to be built by Brown & Kiley, of Northampton, for $1,050, conditionally.

BUILDINGS.

THE NEW DEPOT at LENOX, Mass., has been commenced and will be completed in about two months. It will be 41 by 21 feet, with two waiting rooms, ticket office and baggage room, and a side track will be laid there for freight business.

NEW POST OFFICE FOR WILLIAMSPORT, PA.—Under a suspension of the rules the House passed a bill, appropriating $100,000 for general government offices at the above mentioned place.

HOPKINTON, Mass., votes $13,500 for a new town hall.

LABOR.

BRICK MASONS of Council Bluffs, Ia., have united in demanding $5 per day.

STRIKE IN THE MINES.—It is reported that the Clearfield, Pa., miners have decided to strike.

TRACKMEN STRIKING.—On June 25 200 Erie Railroad trackmen struck.

THE STREET PAVERS of Baltimore have struck for an advance of from $3.50 to $4 per day.

THE STRIKE of the freight-handlers in this city has seriously delayed freight. The result cannot be foretold, and if the dissatisfaction spreads to other branches of railroad employés the effect upon transportation will be most serious. The men demanded an advance of from 17 cents to 20 cents per hour.

SIXTEEN thousand men are now employed in railroad construction in Florida.

N. Y. BOILER MAKERS.—The strike of the boiler makers of this city has ended. The men secured an advance of 10 per cent., or from $2.60 to about $2.86 per day.

STRIKE OF BALTIMORE PAVERS.—The granite block street pavers employed by the City Commissioners and those employed by contractors on city work struck for increased wages. They receive now $3.50 per day for ten hours' work, and demand $4 per day.

LABOR is scarce in many sections of North Carolina.

BRIDGES.

ANOTHER MISSISSIPPI RIVER BRIDGE.—A Washington note states that Mr. McCoid, of Iowa, has secured the passage of a bill authorizing the Rock Island & Southwestern Railroad to build a bridge across the Mississippi River at New Boston, Ill.

THE PONTOON BRIDGE across the Mississippi at Wabasha, Minn., will be ready for service by July 10.

THE RED RIVER BRIDGE.—The machinery for the construction of the railroad bridge over Red River arrived at Shreveport, La., June 21, on the steamer Jewell, and work will be commenced soon.

CHARLESTOWN BRIDGES.—The commission appointed to consider the most practicable method of providing adequate bridge facilities between Charlestown and the city proper have, it is said, reached a conclusion and will submit a report to the City Council in about a week. The plan agreed upon, it is understood, contemplates the erection of an elevated bridge at a point near the present Charles River bridge, and the widening and otherwise enlarging of Warren bridge. The latter structure is considerably out of repair, and within a few years would have to be substantially rebuilt; and in view of the extensive amount of traffic which daily occurs to and from Charlestown in consequence of the increased railroad terminal facilities, the present time is deemed the best to make the changes in this bridge. The present width of the bridge is forty feet, and it is intended to make it eighty feet in width, which will furnish ample accommodations for many years to come. The cost of the improvement is estimated at about $400,000. The elevated bridge is considered a necessity in order to provide for light teams and horse-car travel which is now frequently interrupted in crossing the tracks of the Fitchburg Railroad, over which a large number of trains are passing daily to and from the wharves owned and controlled by that company. The approach to the upper part of the bridge on the Charlestown side will be near City square, and as the highway will be above the railroad tracks it will obviate the difficulties now encountered. The lower deck of the bridge will be used for heavy teams which cannot ascend the grade necessary to reach the upper section, and by furnishing ample accommodations for the two classes of travel alluded to, it is expected that all wants will be met for a quarter of a century at least, if not for a longer period. The cost of an elevated bridge would be in the vicinity of $1,000,000.—*Boston Journal.*

A MISSOURI BRIDGE.—The work of rip-rapping the Hannibal bridge piers began yesterday, under the supervision of Chief Engineer Gill, of the bridge. There will be about 600 yards of rock put around the piers.—*Hannibal Journal.*

ILLINOIS BRIDGE.—The people of Lacon have made a bargain to build a bridge over the Illinois for $15,000. The bridge has a pontoon draw.

MISCELLANEOUS.

SCOTLAND comes to Michigan for oak for its railway cars.

LEVELING BETWEEN NEW YORK AND SAN FRANCISCO.—A government surveying party is now in Daviess County, Ind. They are engaged in taking the level of the country, on a line as nearly due east and west as they can conveniently between San Francisco and New York. They make about six miles per day, this hot weather.—*Western Exchange.*